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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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# INTRODUCTION

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## INDEXING VOCABULARY

The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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**02 Aircraft** 2871
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

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Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

**04 Biosciences** 2881
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

**05 Biotechnology** 2886
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

**06 Chemistry** 2891
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

**07 Communications** 2893
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**08 Computers** 2896
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

**09 Electronic Equipment** 2898
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

**10 Electronics** 2899
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

**11 Facilities, Research and Support** 2900
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

**12 Fluid Mechanics** 2901
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

**13 Geophysics** 2911
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

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**18 Materials, Nonmetallic** 2937
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Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

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**21 Navigation** 2950
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

**22 Nuclear Engineering** 2951
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**30 Space Sciences** 2977
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**31 Space Vehicles** 2982
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**32 Structural Mechanics** 2987
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**33 Thermodynamics and Combustion** 2990
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

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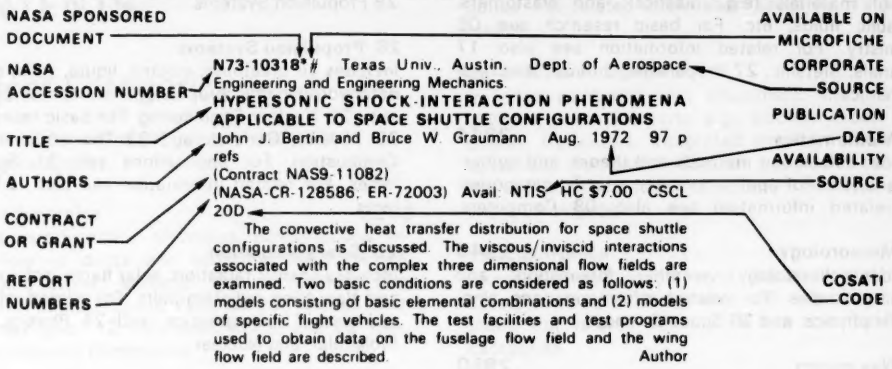
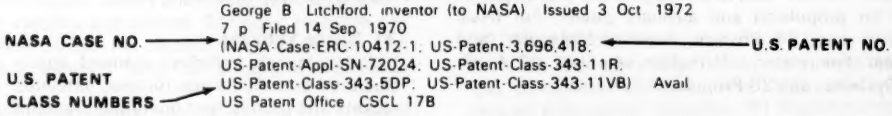



N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
**HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS**
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586, ER-72003) Avail: NTIS HC $7.00 CSCL 20D

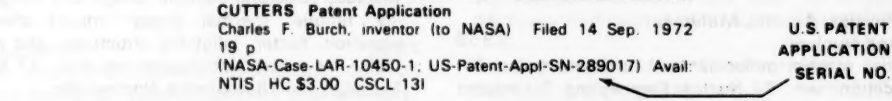
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

## PATENT CITATION



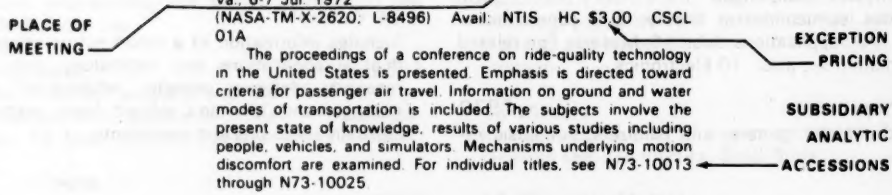

N73-12211* National Aeronautics and Space Administration Manned Spacecraft Center, Houston, Tex.
**ALTITUDE MEASURING SYSTEM Patent**
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

## PATENT APPLICATION CITATION




N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application**
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

## PRIMARY ANALYTIC CITATION AND ABSTRACT




N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**SYMPOSIUM ON VEHICLE RIDE QUALITY**
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620, L-8496) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025

## SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
**AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA**
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02)
CSCL 01A

VOLUME 11 NUMBER 24 / DECEMBER 23, 1973

# Scientific and Technical Aerospace Reports

*A Semimonthly Publication of the National Aeronautics and Space Administration*

## 01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

**N73-32922** New York Univ., N.Y.
**ANALYSIS OF THE LOW-SPEED FLOW OVER A SLENDER SHARP-EDGED DELTA WING AT ANGLES OF ATTACK Ph.D. Thesis**
Paul LeRoy Coe 1973 75 p
Avail: Univ. Microfilms Order No. 73-19383

The phenomena of rolled-up vortex cores above the lee surface of slender bodies, at angle of attack, has been observed since the advent of the highly swept-wing aircraft. Investigations indicate that these vortices exhibit large effects on the longitudinal and lateral stability of these configurations. Because of its geometric simplicity, an untwisted, uncambered, thin, sharp-edged, slender delta wing in subsonic flow is considered. Experimental studies have established the essential features of this type of flow as follows: (1) separation of flow at the leading edges, (2) formation of rolled-up vortex cores above the lee surface, (3) entrainment of mass by the vortex cores, (4) strong axial velocities along the vortex cores and (5) conical flow over the major portion of the wing (with the exception of the apex and trailing edge).
Dissert. Abstr.

**N73-32923** Maryland Univ., College Park.
**AERODYNAMIC FORCES ON OBJECTS IN THE NEARLY FREE MOLECULAR FLOW REGIME Ph.D. Thesis**
William Aaron Kuperman 1972 187 p
Avail: Univ. Microfilms Order No. 73-18251

The drag of an object moving in a rarefied gas is discussed. The first (inverse) Knudsen number correction to the drag in the free molecular flow regime is determined by a set of collision integrals associated with the dynamics of two gas molecules in the presence of the object. These collision integrals are analogous to the three-particle collision integrals derived earlier for the transport properties of a moderately dense gas if one of the particles is replaced with the object. Collision integrals for a number of cases assuming a gas of hard sphere molecules which scatter diffusively with the object are calculated. For a sphere moving at low velocity the result is in agreement with Millikan's data for the drag coefficient of oil droplets. For a cylinder and a strip the coefficient of a term logarithmic in the expansion parameter is obtained.
Dissert. Abstr.

**N73-32924*#** Remtech, Inc., Birmingham, Ala.
**WING TIP VORTEX MEASUREMENTS WITH LASER DOPPLER SYSTEMS**
Charles E. Fuller, III Apr. 1973 79 p refs
(Contract NAS8-25898)
(NASA-CR-124444; RTR-002-3) Avail: NTIS HC $6.00 CSCL 01A

The vortex velocity field produced by a rectangular wing in a subsonic wind tunnel was measured using two laser Doppler velocimeter systems. One system made three dimensional mean velocity measurements and the other made one dimensional turbulence measurements. The systems and test procedures are described and comparisons of the measurements are made. The data defined a strong spiral motion in the vortex formation process.
Author

**N73-32925#** Defence Research Establishment Valcartier (Quebec).
**GROWTH CHARACTERISTICS OF TURBULENT WAKES**
C. Lahaye and P. Doyon May 1973 18 p refs
(DREV Proj. 95-51-10)
(DREV-R-687/73) Avail: NTIS HC $3.00

Recent advances in the experimental study of hypersonic wakes have led to spatially resolved measurements of the behavior of the important physical variables which characterize the wake. Previous measurements pertained mainly to the wake growth and were achieved by an integrated-type technique using a schlieren system. In relating the new measurements with the earlier ones, and to provide a basis for comparing growth results obtained from the spatially resolved measurements, schlieren films of model wakes taken have been utilized to obtain wake growth data at the same velocities and pressures as those of the spatially resolved measurements. Both cone and sphere wakes have been investigated. Results show that the effect of P x D (pressure times body diameter) on wake growth is negligible, while Mach number has a strong effect. Turbulent wake growth can be described.
Author

**N73-32926*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**AN EXPERIMENTAL INVESTIGATION OF THREE OBLIQUE-WING AND BODY COMBINATIONS AT MACH NUMBERS BETWEEN 0.60 AND 1.40**
Lawrence A. Graham, Robert T. Jones, and Frederick W. Boltz Apr. 1973 173 p refs
(NASA-TM-X-62256) Avail: NTIS HC $10.75 CSCL 01A

An experimental investigation was conducted in an 11- by 11-foot transonic wind tunnel to determine the aerodynamic characteristics of three oblique high aspect ratio wings in combination with a high fineness-ratio Sears-Haack body. The three wings had the same elliptical planform and base line curvature but had different airfoil sections. One wing had an airfoil section designed to have a lift coefficient of 1.0 at a Mach number of 0.7, another to have shock-free supersonic flow over the upper surface, and the other to have a lift coefficient of 1.3 at a Mach number of 0.6. Longitudinal and lateral-directional stability data were obtained at wing yaw angles of 0 deg, 45 deg, 50 deg, and 60 deg over a test Mach number range from 0.6 to 1.4 for angles of attack between minus 7 deg and 9 deg. Reynolds numbers for the study were 4 and 6 million per foot. Flow-visualization studies were made to examine the nature of the flow on the wing surfaces. Notable differences were found in the aerodynamic characteristics of the three wing-body combinations, particularly in the lateral-directional characteristics.
Author

**N73-32927*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**AN EXPERIMENTAL INVESTIGATION OF AN OBLIQUE-WING AND BODY COMBINATION AT MACH NUMBERS BETWEEN 0.60 AND 1.40**
Lawrence A. Graham, Robert T. Jones, and Frederick W. Boltz Dec. 1972 371 p refs
(NASA-TM-X-62207) Avail: NTIS HC $20.75 CSCL 01A

An experimental investigation was conducted in an 11- by 11-foot wind tunnel to determine the aerodynamic characteristics of an oblique high aspect ratio wing in combination with a high fineness-ratio Sears-Haack body. Longitudinal and lateral-directional stability data were obtained at wing yaw angles from 0 deg to 60 deg over a test Mach number range from 0.6 to 1.4 for angles of attack between minus 6 deg and 9 deg. The effects of changes in Reynolds number, dihedral, and trailing-edge angle were studied along with the effects of a roughness strip on the upper and lower surfaces of the wing. Flow-visualization studies were made to determine the nature of the flow on the wing surfaces. Author

**N73-32928#** Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
**TURBULENT BOUNDARY LAYER STUDIES AT HIGH REYNOLDS NUMBERS AT MACH NUMBERS BETWEEN 0.2 AND 2.8**
K. G. Winter and L. Gaudet London Aeron. Res. Council 1973 102 p refs Supersedes RAE-TR-70251; ARC-33345
(ARC-R/M-3712; RAE-TR-70251; ARC-33345) Avail: NTIS HC $7.25; HMSO £3.55; PHI $13.76

Measurements of the turbulent boundary layer on the sidewall of an 8 by 8 ft wind tunnel are described. The measurements consisted of surface shearing stress, using a large strain-gauge balance, together with velocity and temperature profiles. Maximum Reynolds numbers, based on an effective streamwise run, range from about 200 million at M = 0.2 to 60 million at M = 2.8. The analysis of the results shows that accepted descriptions of turbulent boundary layers in incompressible flow, derived from the concept of a universal velocity defect law, are preserved for compressible flows if the boundary-layer parameters are expressed in kinematic form. This leads to a simple method of calculating skin friction and velocity profiles for constant pressure flows without heat transfer. Author (ESRO)

**N73-32929#** Royal Aircraft Establishment, Farnborough (England). Structures Dept.
**RELATIVE FREQUENCY OF OCCURRENCE OF DIFFERENT NORMAL ACCELERATIONS AT THE CENTRE OF GRAVITY OF AIRCRAFT IN TURBULENCE**
J. Taylor London Aeron. Res. Council 1973 60 p refs Supersedes RAE-TR-71169; ARC-33503
(ARC-R/M-3714; RAE-TR-71169; ARC-33503) Avail: NTIS HC $5.00; HMSO £2.15; PHI $8.33

An examination is made of the relative frequency of occurrence of different normal accelerations, at points near the aircraft centre of gravity of 5 different aircraft, from about 200 hours of research flying sub-divided into about 12000 time periods mainly of about 1 minute. It is shown that the commonly used assumption of a Rayleigh distribution for vertical gust velocity maxima for each period gives poor estimates of the cumulative totals of all the periods for each aircraft. If, however, it is assumed that (1) the frequency of occurrence of different magnitudes of the maxima of the gust velocity vector is a Rayleigh distribution, and (2) the vector changes direction sufficiently slowly for the maxima of the components to occur at the same time as the maxima of the vector, hold for each period, the estimates of the cumulative totals of all the periods for each aircraft do not differ significantly from the measurements. Author (ESRO)

**N73-32930#** National Physical Lab., Teddington (England). Aerodynamics Div.
**AN EXPERIMENTAL INVESTIGATION OF WIND-TUNNEL WALL CONDITIONS FOR INTERFACE-FREE DYNAMIC MEASUREMENTS**
A. W. Moore and K. C. Wight London Aeron. Res. Council 1973 45 p refs Supersedes NPL-AERO-1307; N71-17085; ARC-31704
(ARC-R/M-3715; NPL-AERO-1307; ARC-31704) Avail: NTIS HC $4.25; HMSO £1.70; PHI $6.75

**Results are presented of dynamic tests on two model half-wings performing pitching oscillations in a tunnel which has a slotted roof and floor with perforations of variable size behind the slots. A porosity is found which gives small interference for all speeds in the range of Mach numbers from 0.40 to 1.05 and a method is suggested for selecting a wall porosity to give interference-free damping derivatives; interference-free stiffness derivatives are not simultaneously obtained and small corrections to measured values are required.** Author (ESRO)

**N73-32931#** National Physical Lab., Teddington (England). Aerodynamics Div.
**ON THE EFFECTS OF VISCOUS INTERACTION FOR A FLAT DELTA WING AT INCIDENCE**
L. Davies London Aeron. Res. Council 1973 32 p refs Supersedes ARC-32117
(ARC-CP-1237; ARC-32117) Avail: NTIS HC $3.75; HMSO 55p; PHI $2.35

Equations are derived which enable the effects of viscous interaction on the normal force to be assessed for a flat delta wing at incidence. Author (ESRO)

**N73-32932#** Bristol Univ. (England). Dept. of Aeronautical Engineering.
**DECAY OF TRAILING VORTICES**
E. H. Oon London Aeron. Res. Council .1973 65 p refs Supersedes ARC-33215
(ARC-CP-1238; ARC-33215) Avail: NTIS HC $5.25; HMSO £1.05; PHI $4.05

Model wings of various planforms were plunged vertically into a water tank and the vortex patterns on the surface were studied. For each wing the wake drift rate was found to increase with incidence and to decrease with increasing core separation. The wake started off with discrete vortex cores which grew independently, maintained their initial separation, and had peak velocities which decayed as time to the minus one-half power. The edges of the cores ultimately came very close together, and thereafter separation distance between the core centers increased with time, and the peak velocities tended to decay at the reciprocal of time. Author (ESRO)

**N73-32933#** Brussels Univ. (Belgium). Inst. of Applied Mechanics.
**STUDY OF BUFFETING MOTION OF AIR CUSHION VEHICLES [ETUDE DU MOUVEMENT DE PILONNEMENT DES VEHICULES A COUSSAIN D'AIR]**
G. VandeSteen 1973 103 p refs In FRENCH
(NT-33-1973) Avail: NTIS HC $7.25

An aerothermodynamical study of buffeting for three types of air cushion vehicle is presented. The main hypotheses are given. A theoretical study for the skirt type vehicle leads to a third order differential equation from which the stability criterion is derived. Experimental tests show the importance of fan characteristics, quasi uniform flow within the skirt, compressibility effects, and non-linear effects. The peripheral jet type may be represented by a second order linear system using a modified Crewe Eddington potential theory with a good approximation. The two pressure stage vehicle combines both types above. By combining experimental results and theory, a satisfactory approximation was obtained. In all three cases the transient response is damping coefficient lower than the criticial value. ESRO

**N73-32939*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**AERODYNAMIC AND PERFORMANCE CHARACTERISTICS OF EXTERNALLY BLOWN FLAP CONFIGURATIONS**
William G. Johnson, Jr. *In its* STOL Technol. 1972 p 43-54 (For availability see N73-32934 24-02)
CSCL 01A

**N73-32940*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**STABILITY AND CONTROL OF EXTERNALLY BLOWN FLAP CONFIGURATIONS**
Lysle P. Parlett *In its* STOL Technol. 1972 p 55-70 refs (For availability see N73-32934 24-02)
CSCL 01A

**N73-32941*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**AERODYNAMIC CHARACTERISTICS OF A SWEPT AUGMENTOR WING**
David G. Koenig and Michael D. Falarski (Army Air Mobility R and D Lab.) *In its* STOL Technol. 1972 p 71-86 refs (For availability see N73-32934 24-02)
CSCL 01A

**N73-32942*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**ADVANCED AUGMENTOR-WING RESEARCH**
Thomas N. Aiken *In its* STOL Technol. 1972 p 87-96 refs (For availability see N73-32934 24-02)
CSCL 01A

**N73-32943*** Army Air Mobility Research and Development Lab., Hampton, Va.
**AERODYNAMICS OF THE UPPER SURFACE BLOW FLAP**
Arthur E. Phelps, III *In* NASA. Langley Res. Center STOL Technol. 1972 p 97-110 refs (For availability see N73-32934 24-02)
CSCL 01A

**N73-32945*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**AERODYNAMIC LOADS MEASUREMENTS ON EXTERNALLY BLOWN FLAP STOL MODELS**
George C. Greene and Boyd Perry, III *In its* STOL Technol. 1972 p 121-130 (For availability see N73-32934 24-02)
CSCL 01A

**N73-32946*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**EXTERNALLY BLOWN FLAP DYNAMIC LOADS**
Donald L. Lansing, John S. Mixson, Thomas J. Brown (Army Air Mobility R and D Lab., Hampton, Va.), and Joseph A. Drischler *In its* STOL Technol. 1973 p 131-142 (For availability see N73-32934 24-02)
CSCL 01A

**N73-32947*** National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
**SURVEY OF WING AND FLAP LOWER-SURFACE TEMPERATURES AND PRESSURES DURING FULL-SCALE GROUND TESTS OF AN EXTERNALLY BLOWN FLAP SYSTEM**
Donald L. Hughes *In its* STOL Technol. 1972 p 143-156 refs (For availability see N73-32934 24-02)
CSCL 01A

**N73-32948*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**SIMULATOR EVALUATION OF THE FLYING QUALITIES OF EXTERNALLY BLOWN FLAP AND AUGMENTOR WING TRANSPORT CONFIGURATIONS**
David A. Kier, Bruce G. Powers, William D. Grantham, and Luat T. Nguyen *In its* STOL Technol. 1972 p 157-800 refs (For availability see N73-32934 24-02)
CSCL 01A

**N73-32963*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**FLAP NOISE GENERATION AND CONTROL**
David Chestnutt, Domenic J. Maglieri, and Richard E. Hayden (Bolt, Beranek and Newman, Inc.) *In its* STOL Technol. 1972 p 413-426 refs (For availability see N73-32934 24-02)
CSCL 01A

**N73-32964*** National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
**EXTERNALLY BLOWN FLAP IMPINGEMENT NOISE**
Paul L. Lasagna and Terrill W. Putnam *In its* STOL Technol. 1972 p 427-441 refs (For availability see N73-32934 24-02)
CSCL 20A

**N73-32965*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**ACOUSTIC CHARACTERISTICS OF LARGE-SCALE STOL MODELS AT FORWARD SPEED**
Michael D. Falarski (Army Air Mobility Res. and Develop. Lab.), Kiyoshi Aoyagi, and David G. Koenig *In its* STOL Technol. 1972 p 443-454 refs (For availability see N73-32934 24-02)
CSCL 20A

**N73-32966*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EBF NOISE TESTS WITH ENGINE UNDER-THE-WING AND OVER-THE-WING CONFIGURATIONS**
Robert G. Dorsch and Meyer Reshotko *In its* STOL Technol. 1972 p 455-473 (For availability see N73-32934 24-02)
CSCL 20A

**N73-33476*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**AERODYNAMIC SIMULATION TESTS OF RSI PANELS**
F. J. Centolanzi, N. B. Zimmerman, M. A. Covington, and F. H. Nichols *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 371-423 (For availability see N73-33475 24-18)
CSCL 01A

**N73-33478*** General Electric Co., Philadelphia, Pa.
**ENTRY ENVIRONMENTAL SIMULATION TESTING OF REI-MULLITE TPS**
D. E. Florence, R. A. Brewer, and T. E. Hess *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 485-524 refs (For availability see N73-33475 24-18)
CSCL 01A

**N73-33482*** Lockheed Missiles and Space Co., Sunnyvale, Calif.
**SILICA RSI ENTRY SIMULATION TESTS**
R. P. Banas, J. O. Donaldson, and J. Jue *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 623-666 refs (For availability see N73-33475 24-18)
CSCL 01A

**N73-33187** Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
**EXPERIMENTAL STUDY OF WING PROFILE WITH FOWLER FLAPS AND SLATS [EXPERIMENTAL-STUDIE AN EINEM PROFIL MIT FOWLERKLAPPE UND VORFLUEGEL]**
Juergen Barche *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 7-44 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

# 02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

**N73-32934*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**STOL TECHNOLOGY**
Washington 1972 516 p refs Conf. held at Moffett Field, Calif., 17-19 Oct. 1972
(NASA-SP-320) Avail: NTIS HC $9.75 CSCL 01C

The proceedings of a conference on STOL technology are presented. The subjects discussed are: (1) short haul transportation systems, (2) aerodynamic characteristics, (3) aerodynamic loads, (4) flight dynamics, (5) operational aspects, (6) quiet STOL propulsion, and (7) jet powered-lift noise technology. For individual titles, see N73-32935 through N73-32967.

**N73-32935*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**SHORT-HAUL TRANSPORTATION IN THE 1980'S**
Leonard Roberts *In its* STOL Technol. 1972 p 1-8 refs (For availability see N73-32934 24-02)
CSCL 01C

The requirements for short-haul air transportation services in the 1980 time period are analyzed. The identification of short takeoff and landing aircraft to perform this service is reviewed. The adequacy of technical programs for developing short-haul aircraft is examined. The characteristics of several candidate short-haul aircraft are described. A system analysis, to include the economic and environmental factors, is developed. Author

**N73-32936*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**FUTURE SHORT-FIELD AIRCRAFT**
Thomas L. Galloway *In its* STOL Technol. 1972 p 9-22 ref (For availability see N73-32934 24-02)
CSCL 01C

The application of short takeoff and landing aircraft for improving short-haul air transportation is examined. The contracts with industry to study quiet turbofan short-field aircraft in the short-haul air transportation system are identified. Studies of appropriate propulsion systems are conducted in parallel with the aircraft studies. The objectives of the studies are to: (1) determine economic and social viability of short-haul air transportation, (2) identify critical technology and technology-related problems, (3) define representative aircraft configurations and characteristics to include development and operational costs, and (4) to establish desirable technology advances for improving short-haul transportation systems. Author

**N73-32937*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**ECONOMIC AND ENVIRONMENTAL ASPECTS OF STOL TRANSPORTATION** **c34**
Elwood C. Stewart *In its* STOL Technol. 1972 p 23-34 (For availability see N73-32934 24-02)
CSCL 05C

A system study to analyze the question of the impact of advanced STOL aircraft in meeting the needs of short-haul air transportation systems is discussed. The study is concerned with the following aspects: (1) service to the passenger, (2) economic viability, and (3) economic criteria to include community noise, ground and air decongestion, and air pollution. The STOL aircraft parameters are defined. Preliminary conclusions concerning the feasibility of short-haul air transportation are presented. Author

**N73-32938*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**OVERVIEW OF TECHNOLOGY SESSIONS**
Bradford H. Wick *In its* STOL Technol. 1972 p 35-42 (For availability see N73-32934 24-02)
CSCL 01C

Short takeoff aircraft technology development related to the requirements for an expanded and improved short-haul air transportation system is discussed. Systems requirements are summarized, principal aircraft requirements are identified, the status of STOL technology is analyzed, and the scope of the technology efforts covered by the conference are outlined. Charts and diagrams are provided to explain system requirements, lift capability trends, and terminal airspace requirements. Author

**N73-32939*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**AERODYNAMIC AND PERFORMANCE CHARACTERISTICS OF EXTERNALLY BLOWN FLAP CONFIGURATIONS** **c01**
William G. Johnson, Jr. *In its* STOL Technol. 1972 p 43-54 (For availability see N73-32934 24-02)
CSCL 01A

The application of externally blown flaps for improving the performance of short takeoff aircraft is discussed. The characteristics of externally blown flap powered lift are examined. A method for predicting the aerodynamic performance of a particular externally blown flap configuration is presented. The following specific effects are analyzed: (1) induced aerodynamics, (2) static turning, (3) flap span and deflection, and (4) engine size and chord flap. Author

**N73-32940*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**STABILITY AND CONTROL OF EXTERNALLY BLOWN FLAP CONFIGURATIONS** **c01**
Lysle P. Parlett *In its* STOL Technol. 1972 p 55-70 refs (For availability see N73-32934 24-02)
CSCL 01A

The results of wind-tunnel investigations on the stability and control characteristics of externally blown jet-flap configurations are presented. Conventional wind-tunnel tests and free-flight model tests have shown that longitudinal trim and stability can be achieved by a properly located horizontal tail of sufficient size, and that lateral trim in the engine-out condition can be produced by combinations of differential flap, spoiler, and rudder deflection. Free-flight model tests have revealed a lightly damped Dutch roll lateral oscillation, and have shown that the oscillation can be stabilized by use of artificial damping. Author

**N73-32941*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**AERODYNAMIC CHARACTERISTICS OF A SWEPT AUGMENTOR WING** **c01**
David G. Koenig and Michael D. Falarski (Army Air Mobility R and D Lab.) *In its* STOL Technol. 1972 p 71-86 refs (For availability see N73-32934 24-02)
CSCL 01A

A brief outline of augmentor wing research sponsored by Ames Research Center is presented and is followed by a discussion of large-scale wind-tunnel test results for a swept augmentor wing configuration. The results showed that the augmentor wing could be applied to high-speed swept wing designs with little adverse effect on either the basic performance of the augmentor or the longitudinal characteristics, including maximum lift and stall. Three lateral control devices were shown to be effective and ground effect was measured for several complete aircraft configurations. Author

**N73-32942*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**ADVANCED AUGMENTOR-WING RESEARCH** **c01**
Thomas N. Aiken *In its* STOL Technol. 1972 p 87-96 refs (For availability see N73-32934 24-02)
CSCL 01A

Results of research on advanced augmentors are discussed. Research concerned with performance has indicated that: (1) augmentors with lobe-type nozzles give higher thrust augmentation than those with slot-type primary nozzles, (2) the thrust of augmentor wings at forward speed is greater than that of internally blown flaps for the speed range of interest, and (3) the optimum augmentor geometry at forward speed may be different from the optimum static geometry. Analysis of augmentor-wing data has shown that the data may be correlated by accounting for the augmentation and entrainment in defining a net thrust coefficient. Author

**N73-32943*** Army Air Mobility Research and Development Lab., Hampton, Va.
**AERODYNAMICS OF THE UPPER SURFACE BLOW FLAP** **c01**
Arthur E. Phelps, III *In* NASA. Langley Res. Center STOL Technol. 1972 p 97-110 refs (For availability see N73-32934 24-02)
CSCL 01A

The results of some preliminary wind-tunnel investigations made to provide fundamental aerodynamic information on the upper surface blown jet-flap concept incorporating high-bypass-ratio turbofan engines are summarized. The results of the investigation have shown the concept to have aerodynamic performance generally similar to that of other externally blown high-lift systems. A few of the more critical problems associated with this concept have been identified and preliminary solutions to some of these problems have been found. These results have proven to be sufficiently encouraging to warrant continuation of fundamental research efforts on the concept. Author

**N73-32944*** Army Air Mobility Research and Development Lab., Hampton, Va.
**COMPARISON OF AERODYNAMIC PERFORMANCE OF SEVERAL STOL CONCEPTS**
Danny R. Hoad *In* NASA. Langley Res. Center STOL Technol. 1972 p 111-120 (For availability see N73-32934 24-02)
CSCL 01C

Wind tunnel tests to determine the aerodynamic characteristics of basically similar short takeoff aircraft were conducted. The investigations were designed to provide data for a systematic direct comparison of five of the concepts considered. The configurations of the five models are illustrated and described. The aerodynamic data are presented in the form of graphs. It was concluded that the most complex systems require the least amount of net thrust. Author

**N73-32945*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**AERODYNAMIC LOADS MEASUREMENTS ON EXTERNALLY BLOWN FLAP STOL MODELS c01**
George C. Greene and Boyd Perry, III *In its* STOL Technol. 1972 p 121-130 (For availability see N73-32934 24-02)
CSCL 01A

Small-scale-model data have shown large static loads on the flap system behind the engines. The large-scale-model tests confirmed the magnitude of these loads and indicated that the relative loading of each flap element depends on the engine-wing-flap geometry. Flap response measurements indicated that the unsteady pressure loading excited the natural vibration modes of the flap system on this model. Since this was a boilerplate model, the only conclusion that can be drawn is that the possibility of large vibration loads must be considered for a flight-weight structure. The similarity of the unsteady pressure and flap response spectra for the wind-off and wind-on cases indicated that it may be possible to realistically test flight-weight flap structures on a static test stand rather than endure the extra costs and scheduling problems associated with large-scale wind-tunnel tests. There is a potential flap-temperature problem which if not resolved might preclude the use of materials such as aluminum and the composites in the flap structure. Author

**N73-32946*** National Aeronautics and Space Administration. Langley Research Center Langley Station, Va.
**EXTERNALLY BLOWN FLAP DYNAMIC LOADS c01**
Donald L. Lansing, John S. Mixson, Thomas J. Brown (Army Air Mobility R and D Lab., Hampton, Va.), and Joseph A. Drischler *In its* STOL Technol. 1973 p 131-142 (For availability see N73-32934 24-02)
CSCL 01A

Some of the principal results obtained in three series of measurements of fluctuating surface pressures induced on externally blown flaps by jet impingment are presented. Large- and small-scale models and hot- and cold-flow tests are considered. The discussion sets forth scaling parameters and consistent features of the root-mean-square values and spectra of the loading. Implications of these results with regard to sonic fatigue are indicated. Author

**N73-32947*** National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
**SURVEY OF WING AND FLAP LOWER-SURFACE TEMPERATURES AND PRESSURES DURING FULL-SCALE GROUND TESTS OF AN EXTERNALLY BLOWN FLAP SYSTEM c01**
Donald L. Hughes *In its* STOL Technol. 1972 p 143-156 refs (For availability see N73-32934 24-02)
CSCL 01A

Full-scale ground tests of an externally blown flap system were made using the wing of an F-111B airplane and a CF700 engine. Pressure and temperature distributions were determined on the undersurface of the wing, vane, and flap for two engine exhaust nozzles (conical and daisy) at several engine power and engine/wing positions. The tests were made with no airflow over the wing. The leading-edge wing sweep angle was fixed at 26 deg, the angle of incidence between the engine and the wing was fixed at 3 deg, and the tests were conducted with the flap retracted, extended and deflected 35 deg, and extended and deflected 60 deg. The integrated local pressures on the undersurface of the flap produced loads approximately three times as great at the 60 deg flap position as at the 35 deg flap position. With both nozzle configurations, more than 90 percent of the integrated pressure loads were contained within plus or minus 20 percent of the flap span centered around the engine exhaust centerline. The maximum temperature recorded on the flaps was 218 C (424 F) for the conical nozzle and 180 C (356 F) for the daisy nozzle. Author

**N73-32948*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**SIMULATOR EVALUATION OF THE FLYING QUALITIES OF EXTERNALLY BLOWN FLAP AND AUGMENTOR WING TRANSPORT CONFIGURATIONS c01**
David A. Kier, Bruce G. Powers, William D. Grantham, and Luat T. Nguyen *In its* STOL Technol. 1972 p 157-800 refs (For availability see N73-32934 24-02)
CSCL 01A

Concurrent simulations of powered-lift STOL transport aircraft having either an externally blown flap configuration or an augmentor wing configuration were conducted. The following types of simulators of varying sophistication were used: (1) a simple fixed-base simulation with a simple visual display, (2) a more complex fixed-base simulation using a realistic transport cockpit and a high-quality visual display, and (3) a six-degree-of-freedom motion simulator that had a realistic transport cockpit and a sophisticated visual display. The unaugmented flying qualities determined from these simulations were rated as unacceptable for both the externally blown flap and augmentor wing configurations. The longitudinal, lateral-directional, and single-engine-failure characteristics were rated satisfactory with extensive augmentation, including pitch and roll command systems, flight-path (or speed) augmentation, turn coordination, and effective yaw damping. However, the flare and landing characteristics from any approach glide-path angle in excess of 4 deg were rated as unsatisfactory but acceptable. Author

**N73-32949*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**FLIGHT-PATH AND AIRSPEED CONTROL FOR THE STOL APPROACH AND LANDING**
James A. Franklin and Robert C. Innis *In its* STOL Technol. 1972 p 181-198 refs (For availability see N73-32934 24-02)
CSCL 01C

Analytical investigations and piloted moving base simulator evaluations were conducted for manual control of flight path and airspeed for the approach and landing of a powered lift jet STOL aircraft. Flight-path and airspeed response characteristics were described analytically and were evaluated for the simulation experiments which were carried out on a large motion simulator. The response characteristics were selected and evaluated for a specified path and speed control technique. These characteristics were the initial flight-path response, flight-path overshoot, flight-path-airspeed coupling in response to a change in thrust, and the sensitivity of airspeed to pitch-attitude changes. Results are presented in the form of pilot opinion ratings and commentary, substantiated where appropriate by response time histories and aircraft states at the point of touchdown. Author

**N73-32950*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**STUDY OF GROUND PROXIMITY EFFECTS ON POWERED-LIFT STOL LANDING PERFORMANCE**
James L. Hassell, Jr. and Joseph H. Judd *In its* STOL Technol. 1972 p 199-213 refs (For availability see N73-32934 24-02)
CSCL 01C

Data from wind-tunnel measurements are presented to show the magnitude of adverse ground effects on the longitudinal aerodynamic coefficients of a powered-lift STOL airplane. A steady-state analysis shows the changes in thrust and angle of attack required during the landing approach and flare as the airplane flies close to the ground. The piloting problems that these ground effects may create were investigated with an in-flight simulator to find the consequences of lift loss during the landing-flare maneuver for a STOL transport. Flight tests were made using the variable stability Navion setup with STOL transport aerodynamics and control responses and were flown at design approach speeds and descent conditions. Author

**N73-32951*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**STATUS OF STOL RIDE QUALITY AND CONTROL**
D. William Conner and W. Elliott Schoonover, Jr. *In its* STOL Technol. 1972 p 215-226 refs (For availability see N73-32934 24-02)
CSCL 01C

A STOL ride-control development program has been initiated with the objective of generating ride-control technology through development and evaluation of an active control system specifically designed to provide ride smoothing on a STOL vehicle. Although much can be learned through analysis, there are deficiencies in technology for translating analysis results into operating hardware. The general approach being followed is to select an existing STOL vehicle for trial and then carry out a study to establish feasibility of a control system or systems to smooth the ride and generate system trade-off data. Author

**N73-32952*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**HEAD-UP DISPLAYS FOR STOL VISUAL APPROACHES** c14
Everett A. Palmer and Fred W. Cronn (San Jose State Univ.) *In its* STOL Technol. 1972 p 227-243 refs (For availability see N73-32934 24-02)
CSCL 01D

A simulation study was conducted to determine the effectiveness of a simple head-up display in improving glide-slope tracking performance during steep visual approaches in a STOL aircraft. The head-up display featured an attitude-stabilized horizon bar and glide-slope reference bar parallel to and 7.5 deg below the horizon bar. On some approaches a flight-path marker symbol showing the projected ground impact point was also displayed. Half of the approaches were flown in a conventional mode in which the pilot changed pitch attitude to correct for height errors. The remaining approaches were flown in a direct-lift mode in which the pilot modulated thrust to change the flight-path angle without pitching the aircraft. Author

**N73-32953*** National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
**A FLIGHT EVALUATION OF CURVED LANDING APPROACHES**
S. W. Gee, M. R. Barber, and T. C. McMurtry *In its* STOL Technol. 1972 p 245-258 refs (For availability see N73-32934 24-02)
CSCL 01C

The development of STOL technology for application to operational short-haul aircraft is accompanied by the requirement for solving problems in many areas. One of the most obvious problems is STOL aircraft operations in the terminal area. The increased number of terminal operations needed for an economically viable STOL system as compared with the current CTOL system and the incompatibility of STOL and CTOL aircraft speeds are positive indicators of an imminent problem. The high cost of aircraft operations, noise pollution, and poor short-haul service are areas that need improvement. A potential solution to some of the operational problems lies in the capability of making curved landing approaches under both visual and instrument flight conditions. Author

**N73-32954*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**PRELIMINARY RESULTS OF FLIGHT TESTS OF THE AUGMENTOR-WING JET STOL RESEARCH AIRCRAFT**
Hervey C. Quigley and Richard F. Vomaske *In its* STOL Technol. 1972 p 259-282 refs (For availability see N73-32934 24-02)
CSCL 01C

The Augmentor-Wing Jet STOL Research Aircraft has been developed and has started flight tests. The objectives of the program are to compare aerodynamic characteristics predicted from wind-tunnel data with data obtained in flight, to determine flight dynamic characteristics and limitations of the augmentor-wing concepts, and to contribute to the development of STOL design and operational criteria. Initial flight test results have shown that the aerodynamic characteristics are close to values predicted from wind-tunnel tests. The lateral-directional stability and control characteristics are satisfactory for research STOL missions with stability augmentation, but the longitudinal control require improvement. STOL take-off distance over 11 m is about 290 m, and landing approach speeds are between 60 and 65 knots. The investigation of the STOL operational and performance characteristics is continuing. Author

**N73-32955*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**COMPARISONS OF SIMULATOR AND FLIGHT RESULTS ON AUGMENTOR-WING JET STOL RESEARCH AIRCRAFT**
Robert C. Innis and Seth B. Anderson *In its* Stol Technol. 1972 p 283-290 (For availability see N73-32934 24-02)
CSCL 01C

The considerations involved in making a piloted simulator an effective research tool in the design and development of new aircraft are discussed. An assessment of the limitations of the simulator in depicting real flight as well as the problem of recognizing erroneous results when the simulator is supplied with incorrect input data is made. Examples of the ways in which the simulator is used to design and develop the augmentor-wing aircraft are presented. Four areas of investigation are: (1) to design the lateral control system for proper feel and response, (2) determine the effect of engine failure during approach, (3) develop the best technique for controlling flight path during approach, and (4) the significance of lift loss in ground effect and how to compensate for such loss. Author

**N73-32956*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**INTEGRATION OF STOL AIRPLANES INTO THE ATC SYSTEM** c21
Paul Peterson, Richard H. Sawyer, and Milton D. McLaughlin *In its* STOL Technol. 1972 p 291-306 Prepared in cooperation with FAA, Washington, D. C. (For availability see N73-32934 24-02)
CSCL 17G

The study involving the STOL airplane and air traffic control is a joint NASA/FAA effort designed to examine the effects of introducing large numbers of STOL airplanes into a high-density terminal area. Simply stated, the objectives of the study are to determine the effects of the STOL airplane on the air traffic control (ATC) system and to determine the effects of the ATC system on the STOL airplane. More specifically, the study seeks to determine the airspace requirements and air traffic control equipment and handling techniques required to accommodate the STOL airplane in the ATC system and the design characteristics, avionics equipment, and flight procedures required to operate the STOL airplane in the air traffic control system. Author

**N73-32957*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**FOUR-D GUIDANCE OF STOL AIRCRAFT IN THE TERMINAL AREA** c21
Thomas Pecsvaradi and Heinz Erzberger *In its* STOL Technol. 1972 p 307-332 refs (For availability see N73-32934 24-02)
CSCL 17G

The primary objective of advanced STOL aircraft is the improvement of the nation's air transportation system by the elimination of delays and congestions associated with today's air travel. A new guidance technique, referred to as 4-D guidance, is being developed to achieve this objective. The 4-D guidance technique synthesizes complex three-dimensional flight paths from a minimum set of input data and flies the aircraft along the paths according to a prespecified time schedule. The two major elements of a 4-D guidance system are the trajectory synthesizer and the control law. Inputs to the trajectory synthesizer are the three-dimensional coordinates of way points, the turning radii, the speed ranges, the acceleration limits, and the arrival times at time control way points. First, the three-dimensional trajectory is computed by using circular arcs and straight lines. Then the airspeed profile, compensated for wind, is calculated to achieve the desired arrival times. The synthesized trajectory is stored as a time sequence of reference states which the aircraft is forced to track by using a linear feedback law. Author

**N73-32958*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**TERMINAL-AREA STOL OPERATING SYSTEMS EXPERIMENTS PROGRAM** c21

Donald W. Smith, DeLamar Watson, and Jay V. Christensen *In its* STOL Technol. 1972 p 333-343 ref (For availability see N73-32934 24-02)

CSCL 01E

A system study to determine the application of short takeoff aircraft for a high speed, short haul air transportation service was conducted. The study focused on developing information which will aid in choosing system concepts, design criteria, operating procedures, landing guidance systems, air traffic control systems, and airborne avionics and flight control systems. A terminal area STOL operating system experiments program was developed. The objectives, program approach, program schedule, typical experiments, research facilities to be used, and program status are discussed. Author

**N73-32959*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**PROGRAM PLAN TO DEVELOP AIRWORTHINESS STANDARDS FOR STOL AIRCRAFT**

Jack E. Cayot (FAA), Robert A. Chubboy (FAA), and Charles S. Hynes *In its* STOL Technol. 1972 p 345-351 refs (For availability see N73-32934 24-02)

CSCL 01C

A program plan to develop criteria for airworthiness standards for STOL transport aircraft is presented. Initially, three different STOL concepts are to be examined with a goal to arrive at a generalized set of standards. The Breguet 941 deflected-slipstream STOL has been initially evaluated on a piloted motion simulator and in flight. Confidence in establishing criteria for airworthiness standards for STOL transport aircraft has been obtained from these studies. Author

**N73-32960*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

**FACTORS INFLUENCING PUBLIC ACCEPTANCE OF STOL NOISE** c05

Philip M. Edge, Jr., Jimmy M. Cawthorn, and Clemans A. Powell, Jr. *In its* STOL Technol. 1972 p 353-365 refs (For availability see N73-32934 24-02)

CSCL 05E

The responses of people to special noise characteristics associated with short takeoff aircraft are discussed. The findings of studies which have yielded data that may be pertinent to community acceptance of short takeoff aircraft noise are presented. A three step program to evaluate public acceptance of short takeoff aircraft noise was conducted. The three steps were: (1) definition of short takeoff aircraft noise characteristics, (2) laboratory tests to evaluate individual responses, and (3) the use of community survey data to extrapolate conventional takeoff aircraft experience. Author

**N73-32961*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**QUIET STOL PROPULSION SESSION INTRODUCTORY REMARKS** c28

Robert W. Schroeder *In its* STOL Technol. 1972 p 367-370 (For availability see N73-32934 24-02)

CSCL 20A

Research activities, preliminary design activities, and system optimization studies in support of the development of advanced, quiet, STOL propulsion systems are discussed. Noise alleviation by means of controlling the source and by means of acoustical treatment receive considerable emphasis. A STOL airplane designed for a given payload has essentially double the installed thrust of a comparable CTOL airplane. Unless compensated for during the design process, this alone will tend to increase the source noise by 3 db. The propulsive lift introduces flap impingement noise or duct and flap scrubbing noise, noise sources not present in CTOL airplanes to any significant degree. These additional noise sources are illustrated. Depending on the specific configuration, this will tend to increase the noise by several db or more. Although the propulsive lift characteristics of STOL airplanes will tend to increase source noise significantly, the proximity of STOL airfields to populated areas leads to STOL noise objectives considerably lower than those currently applicable to CTOL airplanes. Author

**N73-32962*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**ENGINE NOISE TECHNOLOGY** c28

Roger W. Luidens, Donald R. Dietrich, James H. Dittmar, Richard G. Goldman, William A. Olsen, Jr., and Brent A. Miller *In its* STOL Technol. 1972 p 371-412 refs (For availability see N73-32934 24-02)

CSCL 21A

The characteristics of aircraft engine noise are discussed. Data are provided to show the noise produced by the following aircraft components: (1) fan noise, (2) noise suppressing structures, (3) sonic inlets, (4) jet mixing noise due to nozzle flow, and (5) thrust reversers. Charts are developed to show the sound pressure level and the frequencies for each type of noise source. The use of laminates and composite materials to dissipate acoustic power is examined. Author

**N73-32963*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

**FLAP NOISE GENERATION AND CONTROL** c01

David Chestnutt, Domenic J. Maglieri, and Richard E. Hayden (Bolt, Beranek and Newman, Inc.) *In its* STOL Technol. 1972 p 413-426 refs (For availability see N73-32934 24-02)

CSCL 01A

The characteristics of aerodynamic noise generated by the interaction of an airstream with a flap surface are discussed. The location and behavior of various noise sources were investigated to determine optimal quieting techniques. A schematic diagram of the jet-flap concepts being considered for integrated-powered-lift systems for short takeoff aircraft is shown. Each of the concepts has in common high velocity turbulent air flowing over relatively rigid surfaces with resultant production of interaction noise. The nature, location, and control of noise sources which involve the interactions of air flows with airfoil surfaces are examined. Author

**N73-32964*** National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

**EXTERNALLY BLOWN FLAP IMPINGEMENT NOISE** c01

Paul L. Lasagna and Terrill W. Putnam *In its* STOL Technol. 1972 p 427-441 refs (For availability see N73-32934 24-02)

CSCL 20A

Tests of the noise produced by the impingement of the jet exhaust on the wing and flap for an externally blown flap system were conducted with a CF700 turbofan engine and an F-111B wing panel. The noise produced with a daisy nozzle installed on the engine was greater than that produced by a conical nozzle at the same thrust. The presence of the wing next to the test nozzles increased the noise, as did increasing the flap deflection angle. Compared with the conical nozzle, the daisy nozzle produced slightly less noise at a flap deflection of 60 deg but produced more noise at the lower flap deflections tested. Tests showed that the single-slotted flap deflected 60 deg, produced less noise than the double-slotted flaps. Also, maintaining the maximum distance between the exit nozzle and flap system resulted in a minor reduction in noise. Author

**N73-32965*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**ACOUSTIC CHARACTERISTICS OF LARGE-SCALE STOL MODELS AT FORWARD SPEED** c01

Michael D. Falarski (Army Air Mobility Res. and Develop. Lab.), Kiyoshi Aoyagi, and David G. Koenig *In its* STOL Technol. 1972 p 443-454 refs (For availability see N73-32934 24-02)

CSCL 20A

Wind-tunnel investigations of the acoustic characteristics of the externally blown jet flap (EBF) and augmentor wing STOL concepts are discussed. The large-scale EBF model was equipped with a triple-slotted flap blown by four JT15D turbofan engines with circular, coannular exhaust nozzles. The large-scale augmentor wing model was equipped with an unlined augmentor blown by a slot primary nozzle. The effects of airspeed and angle of attack on the acoustics of the EBF were small. Flap deflection had a greater effect on the acoustics of the augmentor wing than did airspeed. The total sound power was also significantly higher for landing indicating that turning in the augmentor generated acoustic energy. Airspeed produced a small aft shift in acoustic directivity with no significant change in the peak

perceived noise levels or sound power levels. Small-scale research of the acoustics for the augmentor wing has shown that by blowing an acoustically-treated augmentor with a lobed primary nozzle, the 95-PNdb noise level goal can be achieved or surpassed. Author

**N73-32966*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EBF NOISE TESTS WITH ENGINE UNDER-THE-WING AND OVER-THE-WING CONFIGURATIONS c01**
Robert G. Dorsch and Meyer Reshotko *In its* STOL Technol. 1972 p 455-473 (For availability see N73-32934 24-02)
CSCL 20A

Noise tests of externally blown flaps with the engine under the wing and engine over the wing configurations were conducted. Flap noise data obtained on a TF-34 aircraft are discussed. Noise data obtained during a free-jet forward-speed-effect analysis are presented. Noise sources associated with upper surface flap blowing are described. Results of a small scale configuration screening study and some large scale model test data are analyzed. The noise data for the engine over wing configurations are compared with the engine under the wing configurations. Author

**N73-32967*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**STOL PROPULSION SYSTEMS c28**
Robert J. Denington, Robert W. Koenig, Michael R. Vanco, and David A. Sagerser *In its* STOL Technol. 1972 p 475-509 ref (For availability see N73-32934 24-02)
CSCL 21A

The selection and the characteristics of quiet, clean propulsion systems for STOL aircraft are discussed. Engines are evaluated for augmentor wing and externally blown flap STOL aircraft with the engines located both under and over the wings. Some supporting test data are presented. Optimum engines are selected based on achieving the performance, economic, acoustic, and pollution goals presently being considered for future STOL aircraft. The data and results presented were obtained from a number of contracted studies and some supporting NASA inhouse programs, most of which began in early 1972. The contracts include: (1) two aircraft and mission studies, (2) two propulsion system studies, (3) the experimental and analytic work on the augmentor wing, and (4) the experimental programs on Q-Fan. Engines are selected and discussed based on aircraft economics using the direct operating cost as the primary criterion. This cost includes the cost of the crew, fuel, aircraft, and engine maintenance and depreciation. Author

**N73-32968*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**FORWARD VELOCITY EFFECTS ON JET NOISE WITH DOMINANT INTERNAL NOISE SOURCE**
U. VonGlahn and J. Goodykoontz 1973 17 p refs Presented at 86th Meeting of Acoustical Soc. of Am., Los Angeles, 30 Oct. - 2 Nov. 1973
(NASA-TM-X-71438; E-7694) Avail: NTIS HC $3.00 CSCL 20A

Acoustic data, with and without forward velocity, were obtained with a circular nozzle using a quiet flow system and one dominated by a low frequency internal noise source (analogous to combustion noise). Forward velocity effects were obtained by installing the test nozzle in a free jet. Farfield noise data were obtained at jet pressure ratios from 1.3 to 1.7 and forward velocities up to 260 ft/sec. With a quiet flow system, jet noise is reduced by forward velocity. With a dominant low frequency core noise source, the portion of the noise spectra dominated by this source was not appreciably affected by forward velocity. Author

**N73-32969*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**FLAP NOISE PREDICTION METHOD FOR A POWERED LIFT SYSTEM**
B. Clark, R. Dorsch, and M. Reshotko 1973 15 p refs Presented at the Aero-Acoustic Specialists Conf., Seattle, 15-17 Oct. 1973; sponsored by AIAA
(NASA-TM-X-71449; E-7717) Avail: NTIS HC $3.00 CSCL 20A

A method is presented for estimating the noise generated by deflection of the engine exhaust for under-the-wing and over-the-wing versions of an externally blown flap configuration for powered lift. Correlation equations and curves are given for the overall sound pressure level and directivity and for spectra scaled to a high bypass 25,000-pound thrust size engine. Data are taken from TF34 engine tests and from large cold flow model tests. The correlations are empirical, and thus application of this prediction procedure is limited to geometrically similar configurations. Application of the method is illustrated by calculated sample footprints. Author

**N73-32970*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**A FLIGHT STUDY OF THE USE OF DIRECT-LIFT-CONTROL FLAPS TO IMPROVE STATION KEEPING DURING IN-FLIGHT REFUELING**
Walter E. McNeill, Ronald M. Gerdes, Robert C. Innis, and Jack D. Ratcliff Washington Oct. 1973 30 p refs
(NASA-TM-X-2936; A-4904) Avail: NTIS HC $3.00 CSCL 01C

To investigate the effectiveness of fast-acting flaps as direct-lift-control (DLC) devices on a fighter airplane, the aileron servo systems of an F-100C variable-stability airplane were modified to provide symmetrical actuation of the surfaces. Initial flight tests using DLC indicated that the task of formation flying and, hence, in-flight refueling could be eased by actuating the DLC flaps through the conventional control stick, with the degree of improvement depending on the basic stability of the receiver aircraft. Results of refueling approaches and connections with U.S. Air Force tankers indicated a moderate overall improvement in vertical station-keeping performance (approximately 19 percent) and a sizeable overall decrease in receiver airplane motions and control activity (approximately 40 percent) with DLC. Author

**N73-32971#** Boeing Commercial Airplane Co., Seattle, Wash.
**THE 727 NOISE RETROFIT FEASIBILITY. VOLUME 3: UPPER GOAL FLIGHT TESTING AND PROGRAM SUMMARY Final Report, Jul. 1971 - Dec. 1972**
D. L. Hiatt and M. B. McKaig Jun. 1973 232 p refs
(Contract DOT-FA71WA-2637)
(FAA-RD-72-40-Vol-3; D6-60196-Vol-3) Avail: NTIS HC $13.75

Modifications performed on a Boeing 727 aircraft to obtain reduced aerodynamic noise are discussed. Level flyovers covering a wide range of thrusts and altitudes were recorded with a widely spaced microphone grid for the study of long range noise propagation. Acoustic, propulsion, and aerodynamic performance analyses were made, along with the physical effects of integrating the modifications on the aircraft. A direct operating cost analysis was prepared based on realistic retrofit installation cost estimates and aircraft performance analyses. Author

**N73-32972#** Federal Aviation Administration, Washington, D.C.
**INTERRELATIONSHIP OF FAA-DOT-NASA PROGRAMS RELATING TO AIRCRAFT CABIN MATERIALS FIRE**
Colin G. Simpson Sep. 1973 21 p refs
(FAA-RD-73-146) Avail: NTIS HC $3.25 CSCL 01C

Aircraft cabin materials fire hazards consisting of flammability, smoke emission, toxic gas emission and flash fire are discussed together with the work ongoing pertinent to these hazards by the FAA and other DOT administrations and the NASA. The relationships among these efforts are considered together with funding estimates for FY 1974. Author

**N73-32973*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**WIND TUNNEL INVESTIGATION OF A LARGE-SCALE UPPER SURFACE BLOWN-FLAP TRANSPORT MODEL HAVING TWO ENGINES**
Kiyoshi Aoyagi, Michael D. Falarski, and David G. Koenig Aug. 1973 69 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62296) Avail: NTIS HC $5.50 CSCL 01C

An investigation has been conducted to determine the

aerodynamic characteristics of a large-scale subsonic jet transport model with an upper surface blowing flap system that would augment lift. The model had a 25 deg swept wing of aspect ratio 7.89 and two turbofan engines with the engine centerline located at 0.256 of the wing semispan. The lift of the flap system was augmented by turbofan exhaust impingement on the Coanda surface. Results were obtained for several flap deflections and engine nozzle configurations at jet momentum coefficients from 0 to 4.0. Three-component longitudinal data are presented with two engines operating. Limited longitudinal and lateral data are presented with an engine out. In addition, limited exhaust and flap pressure data are presented. Author

**N73-32974*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**WIND TUNNEL TESTS OF AN F-8 AIRPLANE MODEL EQUIPPED WITH AN OBLIQUE WING**

Lawrence A. Graham, Robert T. Jones, and James L. Summers Jun. 1973 72 p refs

(NASA-TM-X-62273) Avail: NTIS HC $5.75 CSCL 01C

An experimental investigation was conducted in an 11- by 11-foot transonic wind tunnel to study the lift, drag and stability characteristics of a 0.087-scale model of an operational airplane fitted with an oblique wing. The model wing was of elliptical planform with an unswept aspect ratio of 12.7 and a thickness of 10 percent. All other external geometric features of the model were scaled to the basic full size operational airplane with the engine inlet faired closed. Longitudinal and lateral-directional stability data were obtained with the wing at sweep angles of 0 deg, 45 deg and 60 deg Test Mach numbers ranged from 0.6 to 1.4 deg Angles of attack were between minus 4 deg and 8 deg at zero sideslip. Angles of sideslip were between plus and minus 4 degrees for two angles of attack depending upon the wing configuration. Tests were conducted at a Reynolds number of 6 million per foot except for a few runs when balance capacity limited the Reynolds number to 4 million per foot. Author

**N73-32975*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**NOISE MEASUREMENTS FROM A LARGE-SCALE LIFT FAN TRANSPORT IN THE 40- BY 80-FOOT WIND TUNNEL**

Adolph Atencio, Jr. (Army Air Mobility R and D Lab.) Mar. 1973 77 p refs

(NASA-TM-X-62284) Avail: NTIS HC $6.00 CSCL 01C

Noise data measurements from a large scale lift fan transport model aircraft were made in the 40- by 80-foot wind tunnel. The model had two lift fans in deep inlets in the forward fuselage and two lift-cruise fans in pods on the aft fuselage. The noise data measurements are presented as listings and plots of sounds pressure level versus 1/3-octave center frequency. Author

**N73-32976*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**THEORETICAL STUDY OF LIFT GENERATED VORTEX SHEETS DESIGNED TO AVOID ROLL UP**

Vernon J. Rossow Sep. 1973 39 p refs

(NASA-TM-X-62304) Avail: NTIS HC $4.00 CSCL 01A

The random motions of the vortex elements behind a wing that sheds a disturbed, translating array of vortices are analyzed. The analysis indicates that the wake would diffuse and decay rapidly when viscosity is present and would produce small rolling moments on encountering aircraft. It was found that comparable results could also be achieved with an array consisting of vortices that are equal in magnitude but which alternate in sign. This observation indicates that random motion can probably be achieved with a variety of stepped loadings. Author

**N73-32977*#** General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

**A STUDY OF RAPID ENGINE RESPONSE SYSTEMS FOR AN ADVANCED HIGH SUBSONIC, LONG RANGE COMMERCIAL AIRCRAFT**

J. H. Barber, G. W. Bennett, and T. A. DeRosier Oct. 1973 43 p refs

(Contract NAS3-15544)

(NASA-CR-134496; R73AEG121) Avail: NTIS HC $4.25 CSCL 01C

A dynamic model representing the characteristics of an advanced technology study engine (1985 certification time period) was constructed and programmed on an analogue/digital computer. This model was then exercised to study and evaluate a large number of techniques, singly and in combination, to improve engine response. Several effective methods to reduce engine accelerating time are identified. Author

**N73-32978** Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).

**FLIGHT CONTROL SYSTEMS: REQUIREMENTS AND DESIGN PROBLEMS FROM THE FLIGHT MECHANICS VIEWPOINT [FORDERUNGEN AN FLUGREGELANLAGEN UND AUSLEGUNGSPROBLEME UNTER BESONDERER BERUECKSICHTIGUNG DER FLUGMECHANIK]**

Mar. 1972 209 p refs In GERMAN; ENGLISH summary Proc. of the DGLR Flight Characteristics and Flight Control Panels Meeting, Immenstaad, West Ger., 28-29 Oct. 1971

(DLR-MITT-72-05) Avail: NTIS HC $12.50; ZLDI, Munich 43.90 DM

The application of artificial stabilizing devices to particular cases of instability in flight control is discussed. Based on a unified point of view, basically possible feedback control concepts were derived for aircraft with variable stability. The optimization of a control and damping system for fighter aircraft is described. The specification of a thrust control system for the Airbus A300B is presented. The role of an airborne computer in digital flight control systems is detailed. The DO-31 V/STOL aircraft's control system for vertical velocity regulation is described. The flight control system of the VAK 191 B VTOL fighter aircraft is presented. The design optimization of the flight control systems for light helicopters is exemplified by the BO-105 helicopter. Some effects of artificial stability control are reviewed. For individual titles, see N73-32979 through N73-32988.

**N73-32979** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

**NONLINEAR CONTROL CONCEPTS FOR VARIABLE STABILITY AIRCRAFT [NICHTLINEARE REGLERKONZEPTE FUER FLUGZEUGE VARIABLER STABILITAET]**

G. Gruebel (Bochum Univ., West Ger.) *In* DGLR Flight Control Systems: Requirements and Design Probl. from the Flight Mech. Viewpoint Mar. 1972 p 7-16 In GERMAN (For availability see N73-32978 24-02)

Based on a unified point of view, the basically possible feedback control concepts for aircraft with variable stability are derived and discussed. Treatment is limited to the general nonlinear case; the treatment of a linearized state for stationary flight results as a special case. It is shown that as the basis of the general nonlinear equations of motion of a reference aircraft and a model, the possible control structures can be simply derived, in which process the related control laws are determined by nonlinear equation systems. ESRO

**N73-32980** Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).

**DESIGN OF A MODERN FIGHTER AIRCRAFT CONTROL SYSTEM USING QUADRATIC COST FUNCTIONS [AUSLEGUNG EINES REGELSYSTEMS FUER MODERNE KAMPFFLUGZEUGE MIT HILFE QUADRATISCHER KOSTENFUNKTIONEN]**

G. Schaenzer and R. Stadler *In* DGLR Flight Control Systems: Requirements and Design Probl. from the Flight Mech. Viewpoint Mar. 1972 p 17-36 refs In GERMAN (For availability see N73-32978 24-02)

The optimization of a control and damping system for fighter aircraft is discussed. Essential specifications, such as gust and flight control behavior, and stability, can be described exactly by a single quadratic integral quality criterium (cost function). It is shown that the controller, optimized for minimal costs, gives an especially favorable performance related to flight control, disturbance, stability and parameter sensitivity. The investigation of parameter sensitivity produced indications for technical simplification of the control system structure. ESRO

**N73-32981** Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).

**DESIGN PROBLEMS OF THE AIRBUS A 300 B FORWARD THRUST REGULATOR [PROBLEME BEI DER AUSLEGUNG DES VORTRIEBSREGLERS FUER DEN AIRBUS A 300 B]**
P. Wuest and H. D. Buchholz *In* DGLR Flight Control Systems: Requirements and Design Probl. from the Flight Mech. Viewpoint Mar. 1972 p 37-70 refs In GERMAN (For availability see N73-32978 24-02)

The specification of a thrust control system for the Airbus A 300 B is discussed. This sub-system of the automatic pilot is a further development of a similar system tested in a Lufthansa Boeing 707. The sub-system is to control the flight speed in relation to indicated air speed by operating the throttle. The following points are discussed: in the absence of disturbances, a specified flight speed should be reached; the system should be stable; when flying through gusts, throttle activity should not exceed a certain limit; in the case of wind shear the flight deviation should not exceed a certain limit; in the case of configuration changes, e.g. in lowering flaps or undercarriage, the flight deviation should not exceed a certain limit. ESRO

**N73-32982** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
**PROBLEMS OF AIRBORNE COMPUTER AIDED DIGITAL CONTROL SYSTEMS [BEITRAEGE ZUR PROBLEMATIK VON BORDRECHNERGESTUETZTEN DIGITALEN REGELUNGSSYSTEMEN]**
E. Kienzle and G. Schweizer *In* DGLR Flight Control Systems: Requirements and Design Probl. from the Flight Mech. Viewpoint Mar. 1973 p 71-95 In GERMAN (For availability see N73-32978 24-02)

The role of an airborne computer in digital flight control systems is discussed. The following problems in the design of such a system are detailed: (1) models of the processes to obtain adaptive properties in each separate phase, and desired flight characteristics by adaptive behavior in all flight phases; (2) integrated information presentation for observation of control and surveillance problems by the human operator; (3) integration of the operator in the total system; and (4) integration of the onboard computer in the total system. ESRO

**N73-32983** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
**PROBLEMS OF AN INTEGRATED FLIGHT CONTROL AND REGULATION SYSTEM FOR LIFT FAN/VSTOL AIRCRAFT TAKING THE DO-31 VERTICAL VELOCITY REGULATOR AS AN EXAMPLE [ERLAEUTERUNG DER PROBLEME EINER INTEGRIERTEN FLUGSTEUERUNGS- UND REGELUNGSANLAGE FUER HUBBLAESER-VSTOL-FLUGZEUGE AM BEISPIEL DES DO 31-VERTIKALGESCHWINDIGKEITSREGLERS]**
K. Daser *In* DGLR Flight Control Systems: Requirements and Design Probl. from the Flight Mech. Viewpoint Mar. 1972 p 97-110 In GERMAN (For availability see N73-32978 24-02)

The DO-31 V-STOL aircraft's integrated flight control system for vertical velocity regulation is discussed for the gliding and transition phase, as these phases have the highest requirements with regard to performance and reliability. It was found that in augmenting the demands on the flight control system of a VTOL aircraft, the signal processing effort increases. As long as the maximal hand forces of the pilot determine the force level to be processed, a mechanical signal processing will be the main contribution in weight to the control system. A remedy would be mechanical signal processing at low force level, something similar to servo control, or electrohydraulic control with electric signal processing. ESRO

**N73-32984** Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
**THE VAK 191 B FLIGHT CONTROL SYSTEM AND RESULTING NEW DEVELOPMENTS FOR THE NEXT V/STOL FIGHTER AIRCRAFT GENERATION [DAS REGELUNGSSYSTEM DER VAK 191 B UND DARAUS RESULTIERENDE NEUERE ENTWICKLUNGEN FUER DIE NAECHSTE GENERATION VON V/STOL-KAMPFFLUGZEUGEN]**
H.-H. VonSalzen and W. Sobotta *In* DGLR Flight Control Systems: Requirements and Design Probl. from the Flight Mech. Viewpoint Mar. 1972 p 111-144 refs In GERMAN (For availability see N73-32978 24-02)

The flight control system of the VAK 191 B VTOL fighter aircraft for gliding and transition flight phases, based on nonlinear feedback, is discussed. The main problems in flight control are unclearly defined requirements of the relation between aircraft and control systems, the mostly nonlinear parameter variations of the control circuit with the application conditions, and the desired high reliability of the system. The VAK 191 B is used as an example to show possible solutions to these problems. A parameter insensitive controller for a supersonic aircraft, as well as a parameter sensitive controller, are described. The problems of redundant systems and the related error disparity are touched upon. For all solutions, applicability to existing specifications is discussed. ESRO

**N73-32985** Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
**DESIGN OPTIMIZATION AND TESTING OF FLIGHT CONTROL SYSTEMS FOR LIGHT HELICOPTERS [OPTIMALE AUSLEGUNG UND ERPROBUNG VON FLUGREGELUNGSSYSTEMEN FUER LEICHTE HUBSCHRAUBER]**
Herbert Koenig *In* DGLR Flight Control Systems: Requirements and Design Probl. from the Flight Mech. Viewpoint Mar. 1972 p 145-170 refs In GERMAN (For availability see N73-32978 24-02)

Based on the flight dynamic properties of the BO-1-5 helicopter with hingeless rotor, characterized by very good controllability, the influence over several controller concepts was investigated. Flight control systems consisting of a fast controller (with authority limitation of the regulating distance) as attitude stabilizers, and a slow controller as automatic trimmers (with limitation of the regulating speed), were found to be the optimal controller concepts for this type of helicopter. A further optimal concept results from addition of an altitude control, which includes the trimmer system. The investigations and tests have shown that, with relatively little effort, pilot activity can be considerably simplified. ESRO

**N73-32986** Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
**EFFECT OF ARTIFICIAL STABILITY ON AIRCRAFT PERFORMANCES [EINFLUSS DER KUENSTLICHEN STABILITAET AUF DIE FLUGLEISTUNGEN]**
D. Reich *In* DGLR Flight Control Systems: Requirements and Design Probl. from the Flight Mech. Viewpoint Mar. 1972 p 171-186 In GERMAN (For availability see N73-32978 24-02)

Based on the control configured vehicle (CCV) concept, i.e. taking account of the flight control during the design phase, the effect of an artificial longitudinal stability on the performance of aircraft was investigated. In consequent application of the CCV concept, in the most favorable cases a decrease of about 15% in takeoff weight (for the same radius of action) or an increase of 11% in radius of action (for the same takeoff weight) can be achieved. For a fighter aircraft, it is shown that the advantages of an artificial longitudinal stability are obtained for high lift coefficients and for plane wing-body drag polars. ESRO

**N73-32987** Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
**FLIGHT MECHANICAL AND CONTROL TECHNICAL CONSIDERATIONS OF ARTIFICIAL STABILITY AIRCRAFT [FLUGMECHANISCHE UND REGELUNGSTECHNISCHE GESICHTSPUNKTE FUER FLUGZEUGE KUENSTLICHER STABILITAET]**
G. K. Kissel *In* DGLR Flight Control Systems: Requirements and Design Probl. from the Flight Mech. Viewpoint Mar. 1972 p 187-196 In GERMAN (For availability see N73-32978 24-02)

The effects of artificial aircraft stability control on the damping behavior, and the recovery of static stability by means of controllers, are discussed. In designing aircraft the rule that static stability should be available to obtain airworthiness is of major importance. If this rule is not maintained, a reduction of the induced trimming resistance and an increased maneuverability performance can be gained. Airworthiness should then be regained artificially using flight controllers. The improvements obtained in damping behavior are descirbed, and the possibilities of regaining static stability are surveyed. ESRO

**N73-32988** Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
**BASIC TECHNICAL DESIGN OF THE CONTROL SYSTEM FOR AN ARTIFICIAL STABILITY AIRCRAFT [GRUNDSAETZLICHER TECHNISCHER ENTWURF DES STEUERUNGSSYSTEMS FUER EIN FLUGZEUG MIT KUENSTLICHER STABILITAET]**
L Goumas *In* DGLR Flight Control Systems: Requirements and Design Probl. from the Flight Mech. Viewpoint Mar. 1972 p 197-209 In GERMAN (For availability see N73-32978 24-02)

The fundamental design of a pitching axis control system for aircraft with artificial stability is discussed. This control system is based on the measurement of the angular deviation with an air current directional sensor. In order to prevent sensor failures and for consolidation of signals with disparities, the outputs of the air current directional sensor are blocked with supervisory circuits. The produced feedback signal was compared with the control branch signal, and the difference signal passed on to the pitch controller. A hydraulic actuator on the horizontal tail surface closes the feedback circuit. ESRO

**N73-32989#** Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
**[AIRSHIPS: PAST, PRESENT, AND FUTURE] [BERICHT UEBER DAS LUFTSCHIFF-KOLLOQUIUM DER DGLR]**
Aug. 1972 172 p refs In GERMAN; ENGLISH summary Proc. of the DGLR Airship Colloq., Stuttgart, 6 Apr. 1972 (DLR-MITT-72-17) Avail: NTIS HC $10.75; ZLDI, Munich 36,15 DM

The technical and economic aspects of using airships for air transportation are discussed. The history of Zeppelin airships is presented. The cost effectiveness of airship passenger and freight transportation is analyzed. Details of the manufacture of flexible airships are presented and ground and loading operations surveyed. The aerodynamic drag and lift of airships is determined, and drag reduction possibilities discussed. The technical conditions for further airship development, based on present technology, are summarized. For individual titles, see N73-32990 through N73-32995.

**N73-32990** Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
**THE ZEPPELIN AIRSHIP, INITIATOR OF WORLD AIR TRAFFIC [ZEPPELIN, WEGBEREITER DES WELTLUFTVERKEHRS]**
Hans VonSchiller *In its* Airships, Past, Present, and Future Aug. 1972 p 11-25 In GERMAN (For availability see N73-32989 24-02)

The history of Zeppelin airships is presented. The first Zeppelin dirigible flew for 18 minutes on July 1, 1900. The airship was used for civil and military aviation, the latter particularly during World War I. After World War I, the Zeppelin was introduced in the United States, and an Atlantic Ocean crossing was made in 1929. Civil flights to South America were interrupted after the catastrophe of the Hindenburg during the landing of the Graf Zeppelin in Friedrichshafen on 8 May 1937, as a result of which hydrogen gas filling was replaced by nonflammable helium. ESRO

**N73-32991** Deutsche Studiengemeinschaft fuer Luftschiffahrt, Frankfurt am Main (West Germany).
**POSSIBILITIES OF AND PROSPECTS FOR PASSENGER AND FREIGHT TRANSPORT BY AIRSHIPS [MOEGLICHKEITEN UND AUSSICHTEN EINES PERSONEN- UND GUETERTRAN SPORTS MIT LUFTSCHIFFEN]**
Eckart Krueger *In* DGLB Airships: Past, Present, and Future Aug. 1972 p 27-39 In GERMAN (For availability see N73-32989 24-02)

The possibilities and perspectives of using airships for air transportation of passengers and cargo are discussed. Three conditions for successful realization of this concept are: (1) technical realization should be possible, (2) the level of costs involved in construction, manufacturing, and management should allow a selling price leading to a corresponding sales success, and (3) the new product should fit in to the broad spectrum of present offers, and have certain advantages. An important aspect is environment pollution, to which these airships will contribute little. Long-distance flights are seen as the best use because of the airship's hotel-like character. ESRO

**N73-32992** Wuellenkemper (Theodor) KG, Mulheim/Ruhr (West Germany).
**AIRSHIP MANUFACTURE IN MUELHEIM/RUHR [LUFTSCHIFFBAU IN MUELHEIM/RUHR]**
Theodor Wuellenkemper *In* DGLR Airships: Past, Present, and Future Aug. 1972 p 41-48 In GERMAN (For availability see N73-32989 24-02)

Details concerning the manufacture of flexible airships 60 m in length and with a helium gas filling of 6000 cubic m are presented. These airships are to be used for transport of goods, especially in countries with bad roads. The payloads are between 2 and 2.5 tons. ESRO

**N73-32993** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Zentralabteilung Luftfahrttechnik.
**TECHNICAL ASPECTS OF AIRSHIP MANUFACTURE AND OPERATIONS [EINIGE TECHNISCHE FRAGEN ZUM LUFTSCHIFFBAU UND -BETRIEB]**
E. Urbatzka *In* DGLR Airships: Past, Present, and Future Aug. 1972 p 49-66 refs In GERMAN (For availability see N73-32989 24-02)

Some technical aspects of airship manufacture and ground and loading operations are dealt with. Details of possible carrier gases, and altitude control methods are reviewed. Ground handling and freighting operations are discussed. ESRO

**N73-32994** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
**PROBLEMS OF AIRSHIP AERODYNAMICS [PROBLEME DER LUFTSCHIFF-AERODYNAMIK]**
D. G. Papanikas *In* DGLR Airships: Past, Present, and Future Aug. 1972 p 67-113 refs In GERMAN; ENGLISH summary (For availability see N73-32989 24-02)

The possibilities of determining aerodynamic drag and lift on airships by means of known methods for aircraft aerodynamics were investigated. The effectiveness of boundary layer control by means of suction, and some propulsion problems are considered. On the basis of information gathered from an airship literature survey, speed and propulsion power ranges are discussed and compared with those of transport aircraft. ESRO

**N73-32995** Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
**TECHNICAL CONDITIONS FOR A RESTART IN AIRSHIP TECHNOLOGY [TECHNISCHE VORAUSSETZUNGEN FUER EINEN NEUEN START IN DER LUFTSCHIFFTECHNIK]**
Wolfgang VonKirschbaum *In its* Airships, Past, Present, and Future Aug. 1972 p 115-172 In GERMAN (For availability see N73-32989 24-02)

The technical conditions for the development of airships are summarized. The following main points are taken as a background: low structural weight by using carefully optimized modern light construction methods, lightweight propulsion systems with low consumption based on the state-of-the-art of propulsion system technology, and improved maneuverability from stationary and dynamic points of view. ESRO

**N73-32996#** Lockheed-California Co., Burbank.
**EXPERIMENTAL PROGRAM FOR THE DEVELOPMENT OF IMPROVED HELICOPTER STRUCTURAL CRASHWORTHINESS ANALYTICAL AND DESIGN TECHNIQUES. VOLUME 1: COMPUTERIZED UNSYMMETRICAL MATHEMATICAL SIMULATION AND EXPERIMENTAL VERIFICATION FOR HELICOPTER CRASHWORTHINESS IN WHICH MULTIDIRECTIONAL IMPACT FORCES ARE PRESENT Final Technical Report**
Gilbert Wittlin and Max A. Gamon May 1973 224 p refs (Contract DAAJ02-71-C-0066; DA Proj. 1F1-62203-A-529) (AD-764985; USAAMRDL-TR-72-72A-Vol-1) Avail: NTIS CSCL 01/2

The results of a four-phase study to develop helicopter structural crashworthiness analytical and design techniques are presented. The study consisted of the development of a computer

program (KRASH) and the verification of a mathematical model to predict the dynamic response during a survivable accident in which combined vertical and lateral impact velocities are present. Included in the study were a literature survey and evaluation, a detailed analysis of 32 accident cases, a drop test of a UH-1H helicopter with ground impact conditions of 23 fps vertical velocity and 18.6 fps lateral velocity, and parameter studies. It is concluded that program KRASH is capable of accurately predicting the dynamic responses during a multi-directional accident and that the program is a valuable tool with which to perform design tradeoff studies. (Modified author abstract) GRA

**N73-32997#** Army Natick Labs., Mass.
**ADVANCED DEVELOPMENT OF A PARACHUTE RETRO-ROCKET AIRDROP SYSTEM Technical Report, Nov. 1971 - Feb. 1972**
George Chakoian May 1973 96 p
(DA Proj. 1F1-63209-D-B33)
(AD-765422; USA-NLABS-TR-73-59-AD) Avail: NTIS CSCL 01/3

The report proposes a plan for Advanced Development of a Parachute Retrorocket Airdrop System for the airdrop of cargo loads weighing from 2500 to 40,000 pounds from altitudes of 500 feet or less above terrain. The Parachute Retrorocket Airdrop System concept uses relatively small fast opening parachutes for stabilization and preliminary retardation in combination with rockets for final descent velocity control just prior to impact. This capability is required by the U.S. Army to increase delivery accuracy and to provide greater protection to the aircraft by decreasing its detection to hostile radar and fire. The objectives of this plan for advanced development consist of detailed functional, economic and operational analyses of the system, advanced development hardware design, fabrication and flight testing. (Modified author abstract) GRA

**N73-32998#** Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
**ELECTRONIC DISPLAYS IN AIRCRAFT PILOTING [ELEKTRONISCHE DISPLAYS IN DER FLUGFUEHRUNG]**
Jul. 1972 42 p refs In GERMAN; ENGLISH summary Presented at the 12th DGLR Comm. Meeting on Human Factors Engineering, Meckenheim, West Ger., 5 Nov. 1971
(DLR-MITT-72-04) Avail: NTIS HC $4.25; ZLDI, Munich 8.65 DM

Two problems are discribed in the application of electronic display systems to aircraft. The first problem is that of reinforcing the pilot's activity during fully automatic landings; this can be solved by four tasks for advanced displays, whether used for manual control or as a monitor device in automatic landings. The second is the use of predictive displays for manual path and position control of VTOL aircraft. Two displays are discussed and have been tested: an overground display for path control, and an artificial horizon for position control. For individual titles, see N73-32999 through N73-33000.

**N73-32999** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
**POINTS OF VIEW FOR THE INFORMATION DISPLAY IN AIRCRAFT [GESICHTSPUNKTE FUER DIE INFORMATIONSDARSTELLUNG IN FLUGZEUGEN]**
V. Wilckens *In* DGLR Electron. Displays in Aircraft Piloting Jul. 1972 p 7-21 refs In GERMAN; ENGLISH summary (For availability see N73-32998 24-02)

The problem of reinforcing the pilot's activity during fully automatic landings is discussed. The human problem in all-weather landings is analyzed with particular reference to consideration to a larger extent of the real abilities and weaknesses of human beings. Four tasks are discussed which should be fulfilled by advanced displays, whether they are used for manual control or as a monitor device in automatic landings. ESRO

**N73-33000** Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
**USE OF PREDICTIVE DISPLAYS IN THE MANUAL PATH AND POSITION CONTROL OF VTOL AIRCRAFT [DER EINSATZ VON VORANZEIGEN BEI DER MANUELLEN KURS- UND LAGEREGELUNG VON VTOL-FLUGZEUGEN]**
G. Johannsen *In* DGLR Electron. Displays in Aircraft Piloting Jul. 1972 p 23-33 refs In GERMAN (For availability see N73-32998 24-02)

The role of prediction displays for manual control of VTOL aircraft is discussed. The systems investigated are based on the extrapolative method of prediction, and two-parameter control. Two displays are discussed; an overground display for path control, and an artificial horizon for position control both for a simulated VTOL aircraft. A number of tests were carried out to determine the effectiveness of these prediction displays. Results of the overground display show that because of the control task difficulty, the learning phase should last a few days. In the case of the artificial horizon, a clear reduction of the control errors is found by using the predictive display. ESRO

# 03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

**N73-33001** Illinois Univ., Urbana.
**AN EXPERIMENTAL STUDY OF A CARBON-OXYGEN FUEL CELL Ph.D. Thesis**
John Edward Koch 1972 159 p
Avail: Univ. Microfilms Order No. 73-17285

The feasibility of a carbon-oxygen fuel cell, consisting of a solid carbon anode, a nickel gauze cathode, and a flame electrolyte, is experimentally demonstrated. This offers the long range possibility of a coal burning fuel cell. The interaction of combustion and charge transfer has been studied via spectroscopic measurements and measurements of current-voltage relations, temperatures and ion concentration. Cell limiting output, established by its open circuit voltage and short circuit current, were measured over a range of oxygen flows, electrode spacing and ambient pressures. Cell current was correlated with cathode temperature, thus verifying the formation of negative oxygen ion at the cathode by surface ionization. Charge transport through the flame electrolyte was by normal diffusion and by forced diffusion due to the cell internal electric fields. It is concluded that a solid carbon fuel cell is feasible. Dissert. Abstr.

**N73-33002*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**THE ADVANTAGES OF THE HIGH VOLTAGE SOLAR ARRAY FOR ELECTRIC PROPULSION**
Bernard L. Sater 1973 28 p refs Presented at 10th Elec. Propulsion Conf., Lake Tahoe, Nev., 31 Oct. - 2 Nov. 1973; sponsored by AIAA
(NASA-TM-X-71462; E-7758) Avail: NTIS HC $3.50 CSCL 10A

The high voltage solar array offers improvements in efficiency, weight, and reliability for the electric propulsion power system. Conventional power processes and problems associated with ion thruster operation using SERT 2 experience are discussed and the advantages of the HVSA concept for electric propulsion are presented. Tests conducted operating the SERT 2 thruster system in conjunction with HVSA are reported. Thruster operation was observed to be normal and in some respects improved. Author

**N73-33003*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**RUSAP: A COMPUTER PROGRAM FOR THE CALCULATION OF ROLL-UP SOLAR ARRAY PERFORMANCE CHARACTERISTICS**
R. G. Ross, Jr. and J. V. Coyner, Jr. 1 Oct. 1973 54 p refs (Contract NAS7-100)
(NASA-CR-135898; JPL-TM-33-634) Avail: NTIS HC $4.75 CSCL 10A

RUSAP is a FORTRAN 4 computer program designed to determine the performance characteristics (power-to-weight ratio, blanket tension, structural member section dimensions, and resonant frequencies) of large-area, roll-up solar arrays of the single-boom, tensioned-substrate design. The program includes

the determination of the size and weight of the base structure supporting the boom and blanket and the determination of the blanket tension and deployable boom stiffness needed to achieve the minimum-weight design for a specified frequency for the first mode of vibration. A complete listing of the program, a description of the theoretical background, and all information necessary to use the program are provided. Author

**N73-33004#** Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
**POTENTIAL PERFORMANCE OF A TRITIUM-POWERED ISOTOPIC BATTERY**
M. Voinov and H. Tannenberger 1972 20 p Transl. into ENGLISH of Battelle Res. Center Report, Geneva In ENGLISH and FRENCH Presented at the 2nd Intern. Symp. on Power from Radioisotopes, Madrid, 29 May - 1 Jun. 1972
(LIB/Trans-437; Conf-720519-5) Avail: AEC Depository Libraries HC $3.00

Calculations were made for a model isotope powered generator based on direct collection of electrons emitted in the radioactive decay on tritium. The principal parameters in the calculations are the thickness and electrical resistivity of the dielectric which separates the emitter and the collector. When the voltage on the dielectric is kept below its breakdown voltage, the energy conversion efficiency is less than 1%. Author (NSA)

**N73-33005#** California Univ., Livermore. Lawrence Livermore Lab.
**DEVELOPMENT OF MATERIALS FOR ENERGY RELATED APPLICATIONS**
J. S. Kane 10 Apr. 1973 16 p refs Presented at 2d Cairo Solid State Conf., Cairo, 21-26 Apr. 1973 Sponsored by AEC
(UCRL-74697; Conf-730416-2) Avail: NTIS HC $3.00

The application of materials science and technology to develop new energy sources and to make current energy systems more efficient is discussed. The energy sources discussed include solar energy, thermonuclear energy, and fossil fuel energy. Energy conversion techniques discussed include thermal cycles, solar photovoltaic, thermal decomposition of water, and hydrogen-air fuel cells. The methods for energy transmission that are outlined are hydrogen pipelines and superconducting or cyrogenic electrical transmission lines. Transportation optimization and efficiency are dealt with in the light of those components yielding the largest benefit for the overall system. NSA

**N73-33006#** Sandia Labs., Albuquerque, N.Mex. Exploratory Power Supplies Div.
**SOLID ELECTROLYTE THERMAL BATTERY**
D. A. Nissen and R. W. Carlsten Jun. 1973 37 p refs Sponsored by AEC
(SC-RR-72-0386) Avail: NTIS HC $4.00

A study was conducted to determine the feasibility of a thermally activated battery based on the electrochemical system Ag/AgI/I2. Author (NSA)

**N73-33007#** Sandia Labs., Albuquerque, N.Mex.
**ANALYSIS OF LINEAR FOCUSED COLLECTORS FOR SOLAR POWER**
R. B. Pope and W. P. Schimmel, Jr. 1972 7 p refs Sponsored by AEC
(SLA-73-5319; Conf-730811-6) Avail: NTIS HC $3.00

The use of linear focused collectors to collect solar energy in a high-quality (high-temperature) state is analytically studied. The effects of variations in concentration, absorptance, and emittance of the receiver, silvering of the envelope, and system geometry are considered. Convective and radiative transport between the receiver and envelope and from the envelope to the environment are modeled. Radiative exchange processes are modeled with an approximate two-wavelength band model. Calculated results are presented for varying values of specular solar input, linear aperture, concentration, absorptance, emittance, collection temperatures, for both silvered and unsilvered envelopes, and for both evacuated and unevacuated cavities. The study indicates that collector extraction efficiencies of 40 to 60% can be reasonably expected. Highly selective surfaces are relatively unimportant for values of X greater than about 30 if the envelope is silvered. Collector efficiency is increased with increasing linear aperture. The studies indicate that efficient focused collectors providing highquality energy can probably be constructed with available technology. NSA

**N73-33008#** Toulouse Univ. (France). Lab. de Genie Electrique.
**LOSSES IN HIGH-VOLTAGE TRANSFORMERS ENCAPSULATED BY EPOXY RESINS**
M. C. Mayoux (CNRS, Toulouse) and A. AbdElAzim Mar. 1972 5 p refs
Avail: NTIS HC $3.00

Experimental tests of losses in high voltage transformers encapsulated by epoxy resins are presented. Fault detection was performed by X-ray inspection and partial discharges measurement. The transformation ratio variation and the efficiency drop as functions of temperature cycling, stresses, and vibration tests are discussed. The transformer hysteresis loop evolution vs temperature and stray capacity are measured. Results show that the temperature effect is negligible. Strain gage measurements, however, show that the internal pressures developed inside the resin are the main agents in the performance drop. ESRO

**N73-33009#** Naval Ship Research and Development Center, Annapolis, Md.
**HIGH-POWER DENSITY HYDRAZINE FUEL CELLS**
D. E. Icenhower and H. B. Urbach Jun. 1973 17 p refs (SF35431005)
(AD-764530; NSRDC-3934; NSRDC-27-381) Avail: NTIS CSCL 10/2

A hydrazine-oxygen fuel cell was operated under moderate conditions of temperature and concentration at power densities up to 600 watts per square foot (1000 amperes per square foot at 0.6 volt). At this output, a power efficiency of 32% was obtained at 70C at less than molar hydrazine concentration. Power efficiencies exceeding 48% were obtained over a power density range from 40 to 200 watts per square foot by matching the temperature and hydrazine concentration optimally to the electrical load. The three major components of cell polarization were examined. Critical resistance losses were minimized by use of a 0.010-inch asbestos matrix which was more than adequate to prevent leakage of oxygen to the anode at moderate differential pressures. A projected cell thickness of 0.1 inch and a power density of 200 watts per square foot correspond to a calculated stack power-volume ratio of 16 kilowatts per cubic foot. (Modified author abstract) GRA

**N73-33010#** Auburn Univ., Ala. Engineering Experiment Station.
**LOW RIPPLE KLYSTRON POWER SUPPLY FOR EXPERIMENTAL ARRAY RADAR TRANSMITTER Final Report on Part 2, 2 Jun. 1971 - 31 May 1973**
William P. Albritton and Martial A. Honnell Jun. 1973 54 p (Contract DAAH01-71-C-1247)
(AD-765515) Avail: NTIS CSCL 10/2

The report is Part 2 of the Final Report for the Low Ripple Klystron Power Supply, and was prepared to serve as an Instruction Manual. Contained herein is a general description of the power supply, a description of the operation of the individual subsystems, block diagrams, schematics and parts lists. Part 1 of the Final Report, AD-765 512, describes the significant technical problems encountered in the development of the power supply. GRA

**N73-33011#** Army Foreign Science and Technology Center, Charlottesville, Va.
**SOLAR AND WIND POWER TO BE HARNESSED**
Ya. Shefter, G. Aleksenko, N. Lidorenko, S. Iosipyan, and A. Shakhov 1 Nov. 1972 6 p Transl. into ENGLISH from Pravda (Moscow), 11 May 1971 p 3
(AD-765783; FSTC-HT-23-922-72) Avail: NTIS CSCL 10/2

The state-of-the-art of wind and solar power installations are discussed. GRA

# 04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

**N73-33012*** + National Aeronautics and Space Administration, Washington, D.C.
**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 119, SEPTEMBER 1973**
Sep. 1973 74 p refs
(NASA-SP-7011(119)) Avail: NTIS HC $3.50 CSCL 06E

This special bibliography lists 213 reports, articles, and other documents introduced into the NASA scientific and technical information system in September 1973. Author

**N73-33013** Texas Univ., Austin.
**OXYGEN DEFICIT-OXYGEN REPAYMENT RELATIONSHIPS OF MEN IN TREADMILL RUNNING Ph.D. Thesis**
Donald Fraser McMiken 1972 128 p
Avail: Univ. Microfilms Order No. 73-18468

Oxygen uptake and rectal temperature were measured in 30 male college students at baseline, during treadmill running for randomly assigned durations, and for a 30-minute recovery period at baseline work. Results indicated: (1) No difference in O2-repayment for steady-state or non-steady work; (2) O2-repayment was independent of work duration; (3) when workload and intensity were statistically controlled, O2-deficit was not a significant predictor of O2-repayment; (4) workload and intensity together accounted for about 80% of the variance in O2-repayment ($r = .89$, $P < .001$); and (5) work intensity was the best single predictor of O2-repayment accounting for 69% of the variance. Dissert. Abstr.

**N73-33014#** Joint Publications Research Service, Arlington, Va.
**SPACE BIOLOGY AND MEDICINE, VOLUME 7, NO. 4, 1973**
O. G. Gazenko, ed. 10 Oct. 1973 149 p refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, No. 4, Jul. - Aug. 1973 92 p
(JPRS-60248) Avail: NTIS HC $9.50

Articles are presented concerning the selection of cosmonauts; evaluation and analysis of accumulated data to facilitate the on-going transition from orbital to interplanetary flights; reliability of the human component of the man-spaceship system; space psychology and physiology; and environmental problems. For individual titles, see N73-33015 through N73-33037.

**N73-33015** Joint Publications Research Service, Arlington, Va.
**PRINCIPAL CHARACTERISTICS OF A METHOD FOR REGENERATING THE OXYGEN IN PRESSURIZED CHAMBERS BASED ON ELECTROLYSIS WITH USE OF SOLID ELECTROLYTES** **c05**
B. G. Grishayenkov, N. G. Zorina, and S. V. Devyatov *In its* Space Biol. and Med., Vol. 7, No. 4, (JPRS-60248) 10 Oct. 1973 p 1-4 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 3-5 (For availability see N73-33014 24-04)

The main characteristics are given of an electrochemical system with a solid electrolyte designed to regenerate oxygen from human wastes ($CO_2$, $H_2O$). A possible mechanism of electrode reactions, a flow diagram used in supplying oxygen to an enclosed atmosphere, and an evaluation of system performance are described. Author

**N73-33016** Joint Publications Research Service, Arlington, Va.
**COURSE OF THE INFECTIOUS PROCESS AND FUNCTIONAL ACTIVITY OF PULMONARY MACROPHAGES IN MICE CONFINED TO AN ATMOSPHERE WITH A HIGH OXYGEN CONTENT**
A. S. Kaplanskiy, G. N. Durnova, and V. V. Portugalov *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 5-9 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 6-9 (For availability see N73-33014 24-04)

The effect of a hyperoxic atmosphere ($PO_2$ = 304 mm Hg) on the course of the infectious process in the lungs of mice infected intratranasally by Klebsiella pneumonia was studied on the tenth experimental day. The infected animals developed interstitial pneumonia which was not fatal. The pathological process in the lungs of the infected mice developed similarly in the experimental and control mice from both the qualitative and quantitative points of view. No pathological changes were observed in the lungs of noninfected animals sacrificed on the 20th experimental day. The phagocytic activity of alveolar macrophages of experimental mice remained unchanged, whereas activity of succinate dehydrogenase and NAD-dependent and NAD-independent alpha-glycerophosphate dehydrogenase in the macrophage cytoplasm decreased significantly. It is suggested that an evaluation of succinate dehydrogenase activity in alveolar macrophages can be used as a test in measuring the toxic effect of oxygen. Author

**N73-33017** Joint Publications Research Service, Arlington, Va.
**CHANGE IN THE IMPULSE ACTIVITY OF NEURONS IN THE RESPIRATORY CENTER DURING ELECTRIC STIMULATION OF THE VESTIBULAR NERVE AND DORSAL ROOTS IN THE SPINAL CORD**
L. A. Radkevich and G. S. Ayzikov *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 10-16 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 9-13 (For availability see N73-33014 24-04)

Experiments were carried out on adult cats anesthesized with chlonalose nembutal. Impulse activity of 96 respiratory neurons in the medulla oblongata was investigated during electric stimulation of the utricular nerve and dorsal roots of the spinal cord by single square pulses (0.3 to 10 V, 0.5 msec, 1 to 0.3 cps). It was found that vestibular and muscular afferents converge on respiratory neurons in the medulla oblongata. It is noted that the response of single neurons to stimulation of the utricular nerve and dorsal roots was similar in 82.5% of the cases and opposite in 17.5% of the cases. The response of the respiratory neurons was more distinct during stimulation of muscular afferents than during stimulation of the utricular nerve. Those findings indicate that vestibular-respiratory responses may resemble propriorespiratory reactions and that complex stimulation of these sensory systems may bring about a summation effect. Author

**N73-33018** Joint Publications Research Service, Arlington, Va.
**BLOOD SUPPLY TO THE SKELETAL MUSCLES OF RATS DURING HYPOKINESIA**
G. N. Lenskaya *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 17-22 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 14-17 (For availability see N73-33014 24-04)

Quantitative changes in capillary blood flow were studied in vivo in M. semimembraneous and M. soleus of rats exposed to 5-, 15- and 30 day hypokinesia using intravascular injections of india-ink and gelatin mixtures. Blood flow was determined with respect to the number of capillaries per unit area and per one muscle fiber as well as with respect to the total surface of capillaries from the total surface of muscle fibers. M. semimembraneous exhibited a significant increase in the mean radius of the muscle fibers and capillaries. Due to considerable weight losses during the early hypokinetic stages the relative number of capillaries per unit area increased. M. soleus exhibited a significant decrease in the number of capillaries per unit area (by 14-16%) and per muscle fiber. Author

**N73-33019** Joint Publications Research Service, Arlington, Va.
**INFLUENCE EXERTED ON THE ANIMAL BODY BY CONTINUOUS AND DISCONTINUOUS EXPOSURE TO CARBON MONOXIDE**
B. I. Abidin, V. V. Kustov, V. I. Belkin, and L. T. Poddubnaya *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 23-29 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 17-21 (For availability see N73-33014 24-04)

Thirty-day experiments on male white rats demonstrated that continuous (on a 24-hour basis) and intermittent (for four hours daily) exposure to an atmosphere containing carbon monoxide has a similar effect, the daily dosage of the toxic gas being equal. It is suggested that a coefficient of not less than 3 should be used in computing the maximum admissible carbon monoxide concentration for its continuous effect on the basis of the industrial maximum admissible concentration. Author

**N73-33020** Joint Publications Research Service, Arlington, Va.
**FOOD CONSUMPTION AND MORPHOLOGICAL INDICES OF BLOOD IN WHITE MICE WITH THE REPLACEMENT OF AIR NITROGEN BY INERT GASES IN A PRESSURIZED CHAMBER**
A. B. Zimin and N. S. Malinovskaya *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 30-37 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 21-26 (For availability see N73-33014 24-04)

White male mice were exposed for five days to argon-oxygen, helium-oxygen and nitrogen-oxygen atmospheres. Food intakes were thoroughly measured. Significant variations in the amount of food intake were noted and correlated with the gas composition and temperature of the enclosed atmosphere. Changes in blood morphological composition were within the physiological limits normal for laboratory mice, although they indicated a certain relationship with thermal and physical properties of the atmosphere. As compared with the controls, the greatest deviations were noted in a helium-oxygen atmosphere at relatively low temperatures. Author

**N73-33021** Joint Publications Research Service, Arlington, Va.
**EFFECT OF ACCELERATIONS ON THE ACTIVE TRANSPORT OF GLUCOSE IN THE SMALL INTESTINE OF RATS**
K. V. Smirnov and T. A. Sokolova *In its* Space Biol. and Med., Vol. 7, No. 4, (JPRS-60248) 10 Oct. 1973 p 38-43 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 26-29 (For availability see N73-33014 24-04)

The effect of a 20-minute exposure of rats to transverse accelerations on the active transport of glucose in the intestine was investigated. The experiments were carried out 3, 6, 24, 48, and 72 hours after the exposure. Glucose absorption increased three and especially six hours after the exposure. This function underwent a gradual normalization during the 24 hours after exposure on the centrifuge. Author

**N73-33022** Joint Publications Research Service, Arlington, Va.
**DYNAMICS OF WEIGHT CHANGE AND VARIATIONS IN WEIGHT INDICES OF INTERNAL ORGANS IN WHITE MICE AS A FUNCTION OF ATMOSPHERIC COMPOSITION AND DIET**
T. V. Makovkina *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 44-50 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 30-34 (For availability see N73-33014 24-04)

The effect of inert gases on the weight indices and water content and body weights of white mice was studied with respect to various diets. The visceral weight indices of white mice exhibited no significant changes under the influence of the gas composition. The weight and visceral weight indices were dependent primarily on the diet. In a helium-oxygen atmosphere the body weight decreased significantly on the fifth and tenth experimental days. The effect of exposure to an argon-oxygen or nitrogen-oxygen atmosphere was less pronounced. The visceral water content was not affected by either the atmosphere or the diet. Author

**N73-33023** Joint Publications Research Service, Arlington, Va.
**ROLE OF EXTRACARDIAL INNERVATION IN COMPENSATION OF AN ORTHOSTATIC LOAD**
V. Ye. Katkov, A. Ye. Kuvayev, and V. B. Vlasov *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 51-56 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 34-39 (For availability see N73-33014 24-04)

In experiments on anesthesized dogs sympathetic and parasympathetic influences on the heart were eliminated by inderal and atropine combined with a bilateral vagotomy. This decreased the heart rate to three beats per minute, reduced the cardiac output and increased the peripheral resistance. Following chemical denervation the heart rate did not increase during the orthostatic test, the absolute values of peripheral resistance increased, and the mean arterial pressure and cardiac output exhibited no tendency towards normalization, as was the case in experiments without chemical denervation. Cardiac denervation reduced the heart's capacity for compensation for orthostatic loading by about 10-12%. Author

**N73-33024** Joint Publications Research Service, Arlington, Va.
**BIOLOGICAL EVALUATION OF THE INFLUENCE OF A HELIUM-OXYGEN ATMOSPHERE ON A CULTURE OF MAMMALIAN CELLS**
F. V. Sushkov, V. V. Portugalov, I. N. Smolenskaya, Z. K. Sorvacheva, R. L. Arndt, A. G. Dianov, and V. V. Isayenko *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1972 p 57-64 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 33-43 (For availability see N73-33014 24-04)

The cultivation of animal and human cells in vitro in an oxygen-helium atmosphere induced no noticeable changes in the morphological and physiological parameters of the tested cultures. No changes were observed in ten subsequent generations during the successive passages of the cultures under the studied conditions. Author

**N73-33025** Joint Publications Research Service, Arlington, Va.
**INVESTIGATION OF THE POSSIBILITY OF RECORDING THE HUMAN ELECTROENCEPHALOGRAM UNDER THE INFLUENCE OF MUSCLE NOISE** c05
L. N. Nikolskiy and R. A. Vartbaronov *In its* Space Biol. and Med., Vol 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 65-70 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 43-47 (For availability see N73-33014 24-04)

Possible registry of the EEG was studied using two methods for the reduction of muscle noise. This reduction was attained by placing bipolar leads along the midline of the head of the frontoparietal region, the electrodes being located at a distance of 4-5 cm apart, or by an active selective filtration of EEG frequencies in any lead by means of a specially designed summator. Both methods ensured a considerable decrease in muscle noise during man's exposure to accelerations, as well as during arbitrary tension of the mastication muscles. Author

**N73-33026** Joint Publications Research Service, Arlington, Va.
**ANALYSIS OF SOME INDICES OF ELECTRONYSTAGMOGRAMS FOR HEALTHY PERSONS IN LABYRINTHAL CALORIZATION TESTS** c05
D. Bodo, V. P. Baranova, E. I. Matsnev, and I. Ya. Yakovleva *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 71-76 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 47-51 (For availability see N73-33014 24-04)

Electronystagmographic indices were analyzed in 107 healthy persons exposed to caloric irrigation (calorization) by the Fitzgerald and Hallpike method. The results were statistically analyzed. With respect to the three or four parameters studied the reflex activity of the labyrinths exhibited physiological asymmetry due to the greater activity of the right labyrinth. In only four observations was a symmetry of reflex labyrinth activity noted. The mechanism of this phenomenon and the quantitative characteristics of the asymmetry require further study. Author

**N73-33027** Joint Publications Research Service, Arlington, Va.
**STATE OF BLOOD FILLING AND BIOELECTRIC ACTIVITY OF THE BRAIN IN CIRCULATORY HYPOXIA IN HEALTHY PERSONS AND INDIVIDUALS WITH EARLY FORMS OF AUTONOMIC-VASCULAR DYSFUNCTION**
T. N. Krupina, M. P. Aleksandrova, and T. Ya. Pavlova *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 77-85 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 51-56 (For availability see N73-33014 24-04)

The results are presented of a study of 24 healthy persons and 25 individuals with autonomic-vascular dysfunction who were exposed to two-minute alternating occlusion of the carotid arteries for investigating pulse blood filling and cerebral bioelectric activity. The individuals with early forms of autonomic-vascular dysfunction exhibited an increase in eeg changes and lesser deficit of pulse blood filling. The genesis of these changes and the possibility of using simultaneous EEG and REG records in a test with temporary circulatory hypoxia as an additional objective test to be used in the screening of cosmonaut candidates are discussed. Author

**N73-33028** Joint Publications Research Service, Arlington, Va.
**PECULIARITIES OF WATER-MINERAL METABOLISM DURING 120-DAY HYPOKINESIA**
Z. P. Pak, G. I. Kozyrevskaya, Yu S. Koloskova, A. I. Grigoryev, Yu. Ye. Bezumova, and Ye. N. Biryukov *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 86-91 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 56-59 (For availability see N73-33014 24-04)

The results of a study of the fluid-electrolyte balance in four test subjects during a 120-day bedrest experiment are presented. The investigations included measurements of the water consumed and the urine eliminated in 24 hours, changes in body weight, water content in the blood, plasma volume, electrolyte composition of the blood and urine, the rate of glomerular filtration and renal blood flow, osmotic concentration of the plasma and urine. The mentioned parameters changed in a wavelike pattern. Author

**N73-33029** Joint Publications Research Service, Arlington, Va.
**ELIMINATION OF CREATININE IN THE URINE DURING PROLONGED HYPOKINESIA**
I. M. Buznik and S. A. Kamforina *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248 10 Oct. 1973 p 92-99 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 60-64 (For availability see N73-33014 24-04)

Elimination of creatinine in the urine was examined in six test subjects exposed to a 94-day bed rest experiment. Three of them performed physical exercises with energy expenditures of 250 Cal/day. Beginning with the second week of hypokinesia the elimination of creatinine with the urine increased. Beginning with the 50th day of the experiment the test subjects who had performed no exercises exhibited a greater increase in elimination. These changes were traced using the CN index (urine creatinine nitrogen: total urine nitrogen x 100). This index is more precise than the creatinine coefficient and the absolute values, reflects changes in creatinine metabolism and can be recommended for their evaluation. An increase in the CN index gives evidence that catabolic processes predominate in the muscle tissue. Physical exercises do not eliminate but alleviate these changes, exerting a normalizing effect on the metabolism. There is a distinct correlation between creatinine excretion, total urine nitrogen and diuresis. Author

**N73-33030** Joint Publications Research Service, Arlington, Va.
**INFLUENCE OF TRANSVERSE ACCELERATIONS ON ELECTROLYTE COMPOSITION OF PLASMA AND ERYTHROCYTES**
M. M. Kvasova and J. D. Yertanova *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 100-106 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 65-69 (For availability see N73-33014 24-04)

The electrolyte composition of plasma in humans subjected to accelerations exceeding 10 g was investigated by studying osmotic processes in the mitochondria on the basis of the accumulation of potassium and sodium ions. It was found that under the influence of accelerations of 12 and 10 g, there is a decrease in the concentration of potassium ions in the plasma and erythrocytes, whereas the content of sodium ions in the plasma is reduced and in the erythrocytes it is increased. It is concluded that the electrolyte metabolism indices can be used to evaluate tolerance to accelerations. F.O.S.

**N73-33031** Joint Publications Research Service, Arlington, Va.
**PSYCHONEUROLOGICAL PROBLEMS IN MAN'S ADAPTATION TO MODIFIED DIURNAL REGIMES**
O. N. Kuznetsov and A. N. Litsov *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 107-115 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 69-75 (For availability see N73-33014 24-04)

Theoretical and practical aspects of the psychoneurologic and personality problems involved in human adaptation to an altered diurnal regime (circadian cycle) are discussed. Stages and levels discriminated in clinical and experimental desynchronosis are described. The role of anticipation, emotions, personality relationships and self-dependence in assimilating general experience for successful adaptation to an altered circadian cycle are demonstrated. An individual biorhythmological adaptive style is interpreted as a derivative of endogenous and exogenous processes in the course of personality development. The significance is shown of the exterior phase for the development of biorhythmological adaptive capabilities. The main characteristics of the personality which may favor or impede adaptation to an altered circadian cycle are also discussed. Author

**N73-33032** Joint Publications Research Service, Arlington, Va.
**PROBLEMS OF SOCIAL PSYCHOLOGY IN SPACE**
B. S. Alyakrinskiy *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 116-120 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 75-78 (For availability see N73-33014 24-04)

The problems are discussed involved in achieving harmony in the life and work of small groups as applied to prolonged space flights. It was found desirable to separate crew members, bearing in mind their productive unification by ensuring a strict distribution of duties, control of verbal communication and separate rooms for each crew member. It is recommended that as soon as possible specialists detect negative tendencies in the emotions and relationships and that these be eliminated by means of a complete objectivization of their causes, particularly with the aid of daily entries in the diary, for the purpose of correcting possible conflicts and collisions. Author

**N73-33033** Joint Publications Research Service, Arlington, Va.
**CHANGE IN CALCIUM CONTENT IN HUMAN BONE TISSUE ACCOMPANYING THERMAL STRESS**
I. K. Zyuzin, S. M. Gorodinskiy, and Ye. I. Kuznets *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 121-127 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 78-83 (For availability see N73-33014 24-04)

The effect of high ambient temperatures on the mineral content of human bone tissue was studied. Sealed chamber experiments on young healthy male test subjects demonstrated that both short-term and multiday exposures resulted in a decrease in bone optical density and bone demineralization. The exposure was followed by a decrease in trace elements in the plasma, a dropoff of calcium in the red blood cells and its increase in the plasma. The experimental findings make it possible to consider bone demineralization as an integrative index of thermal stress in the human body. Author

**N73-33034** Joint Publications Research Service, Arlington, Va.
**PECULIARITIES OF HUMAN SKIN REACTIONS TO LOTIONS OF DIFFERENT COMPOSITION DURING HYPOKINESIA**
V. V. Zhidkov, V. V. Borschchenko, G. N. Komzalova, and G. A. Vavilkina *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 128-132 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, No. 4, Jul. - Aug. 1973 p 83-86 (For availability see N73-33014 24-04)

The irritating effect of different lotions and distilled water on the human skin was demonstrated in a 30-day bed rest experiment, the irritation increasing with the length of exposure to hypokinesia. The L-211 lotion was better tolerated than the other lotions tested. When recommending the use of various means of personal hygiene for manned space flights it is necessary to take into account the hypokinetic effect, which may increase skin hyperergic reactions. Author

**N73-33035** Joint Publications Research Service, Arlington, Va.
**METHOD FOR AUTOMATIC PROCESSING OF THE INDICES OF AN OPERATOR'S GAS EXCHANGE DURING WORK IN A TRAINER USING A "DNEPRI" ELECTRONIC COMPUTER** c05
V. M. Baranov, M. M. Skvortsov, V. I. Grachev, and A. B. Shneyerov *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248 10 Oct. 1973 p 133-135 Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 86-88 (For availability see N73-33014 24-04)

A system is described for automatically processing results of investigating gas exchange and energy expenditures of operators during experiments. In comparisons of results of tests using this

method with data obtained by manual methods, there was a maximum difference of 6.5%. F.O.S.

**N73-33036** Joint Publications Research Service, Arlington, Va.
**NEGATIVE PRESSURE ON THE LOWER HALF OF THE HUMAN BODY AND THE VOLUME OF CIRCULATING PLASMA**
N. M. Nukharlyamov, V. I. Kopolkov, A. A. Savilov, and B. S. Katkovskiy *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 136-137 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 89-90 (For availability see N73-33014 24-04)

Results are presented of an investigation of the possibility for using lower body negative pressure (LBNP) for preventing a decrease in the volume of circulating plasma during a 30-day hypokinesia. During the period of hypokinesia there was a decrease in the volume of plasma form 43.3 to 31.8 ml/kg by the 22nd day. The use of LBNP beginning with the 26th day led to an increase in the volume, by the 29th day, to 39.4 ml/kg. F.O.S.

**N73-33037** Joint Publications Research Service, Arlington, Va.
**WORK OF THE AEROSPACE SECTION OF THE LENINGRAD SOCIETY OF PHYSIOLOGISTS, BIOCHEMISTS AND PHARMACOLOGISTS IMENI I. M. SECHNOV** c05
G. I. Gurvich, E. V. Bondarev, and V. A. Yegorov *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 138-140 Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 90-91 (For availability see N73-33014 24-04)

The conferences of the aerospace medicine section concerning aviation and space physiology and psychology are briefly reviewed. F.O.S.

**N73-33038*#** Colorado State Univ., Fort Collins.
**[MECHANISMS OF INERT GAS NARCOSIS] Semiannual Status Report**
30 Apr. 1973 78 p refs
(Grant NGR-06-002-075)
(NASA-CR-62096) Avail: NTIS HC $6.00 CSCL 06B

Experiments describing the mechanism of inert gas narcosis are reported. A strain of mice, genetically altered to increase susceptibility to botulin poisoning (synaptic response) appears to increase metabolic rates while breathing argon; this infers a genetically altered synaptic response to both botulin toxin and narcotic gases. Studies of metabolic depression in human subjects breathing either air or a 30% mixture of nitrous oxide indicate that nitrous oxide narcosis does not produce pronounced metabolic depression. Tests on mice for relative susceptibilities to narcosis and oxygen poisoning as a function of fatty membrane composition show that alteration of the fatty acid composition of phospholipids increases resistance to metabolically depressant effects of argon but bas no effect on nitrous oxide narcosis. Another study suggests that acclimatization to low tension prior to high pressure oxygen treatment enhances susceptibility of mice to convulsions and death; developing biochemical lesions cause CNS metabolite reductions and pulmonary damage. G.G.

**N73-33039*#** Maryland Univ., College Park. Dept. of Botany.
**A STUDY OF PHYCOPHYSIOLOGY IN CONTROLLED ENVIRONMENTS Semiannual Status Report and Final Report**
Robert W. Krauss 15 Feb. 1973 100 p refs
(Grant NGR-21-002-003)
(NASA-CR-135796; TR-1024; SASR-24) Avail: NTIS HC $7.00 CSCL 06M

In an attempt to understand the responses of CHLORELLA to various quantities and qualities of light in space flight life support system, studies were designed to give the maximum rates of growth as well as maximum yields at different densities of algae under different light intensities, and under light of different wave lengths. The results of studies on the effects of light on algal growth revealed that the effect was not only positive, as had been assumed in the case of photosynthesis, but that light had a negative action also. Light at the blue end of the spectrum was clearly inhibitory to cell division and vegetative reproduction. Carbon dioxide also limited growth by inhibition of cell divisions in CHLORELLA as well as in the colorless yeast SACCHAROMYCES. Author

**N73-33040*#** Exotech Systems, Inc., Falls Church, Va.
**SCIENTIFIC AND TECHNICAL SERVICES DIRECTED TOWARD THE DEVELOPMENT OF PLANETARY QUARANTINE MEASURES FOR AUTOMATED SPACECRAFT Second Quarterly Report**
10 Oct. 1973 25 p
(Contract NASw-2503)
(NASA-CR-135795; QR-2) Avail: NTIS HC $3.25 CSCL 06M

Planetary quarantine requirements and parameters are evaluated for their effects upon automated spacecraft flights data describing the heat resistance of naturally occuring microorganisms and sterilization requirements are analyzed and a possible method for assessment of these data is developed. Pertinent data from planetary mission microbial contamination logs are compiled and maintained in the quarantine document system. G.G.

**N73-33041*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**PLANETARY QUARANTINE. SPACE RESEARCH AND TECHNOLOGY Semiannual Review, 1 Jan. - 30 Jun. 1973**
Oct. 1973 69 p refs
(Contract NAS7-100)
(NASA-CR-135791; JPL-900-636) Avail: NTIS HC $5.50 CSCL 06M

The impact of satisfying satellite quarantine constraints on outer planet missions and spacecraft design are studied by considering the effects of planetary radiation belts, solar wind radiation, and space vacuum on microorganism survival. Post launch recontamination studies evaluate the effects of mission environments on particle distributions on spacecraft surfaces and effective cleaning and decontamination techniques. G.G.

**N73-33042*#** Uppsala Univ. (Sweden). Dept. of Otolaryngology.
**MORPHOLOGICAL STUDIES OF THE VESTIBULAR NERVE**
Bjoern Bergstroem 1973 41 p refs
(Grants NGR-52-028-003; NGR-52-028-004)
(NASA-CR-135746) Avail: NTIS HC $4.25 CSCL 06P

The anatomy of the intratemporal part of the vestibular nerve in man, and the possible age related degenerative changes in the nerve were studied. The form and structure of the vestibular ganglion was studied with the light microscope. A numerical analysis of the vestibular nerve, and caliber spectra of the myelinated fibers in the vestibular nerve branches were studied in individuals of varying ages. It was found that the peripheral endings of the vestibular sensory epithelia. A detailed description of the sensory cells and their surface organelles is included. K.M.M.

**N73-33043*#** National Aeronautics and Space Administration, Washington, D.C.
**EXCHANGE OF HAND HEAT. THE ROLE OF CIRCULATORY REACTIONS AND VARIATIONS OF THE LOCAL TEMPERATURE OF ARTERIAL BLOODS**
D. Bargeton, J. Durand, J. Mensch-Dechene, and J. Decaud Washington NASA Oct. 1973 47 p refs Transl. into ENGLISH from J. Physiol. (Paris), v. 51, 1959 p 111-150
(Contract NASw-2484)
(NASA-TT-F-15143) Avail: NTIS HC $4.50 CSCL 06P

Heat exchange in the hand was studied as a function of the local thermal conditions, and the conditions of heat transport to the interior of the hand were analyzed. It is found that the temperature of the hand is a function of the surrounding temperature, except below 13 C in water and 5 C in air; increased blood circulation tends to raise the temperature and maintain it at 12 C. However, in the physiological zone, heat loss in the bath at 15 C is almost the same as that observed in a bath at 35 C. Author

**N73-33044#** Battelle-Northwest, Richland, Wash.
**ANNUAL REPORT FOR 1971 TO THE USAEC DIVISION OF BIOLOGY AND MEDICINE. VOLUME 2: PHYSICAL SCIENCES. PART 1: ATMOSPHERIC SCIENCES**
C. L. Simpson Dec. 1972 198 p refs
(BNWL-1651-Vol-2-Pt-1) Avail: NTIS

Evaluations are given for siting nuclear facilities assess

radiation exposures and hazards from routine low level releases during normal operations and from accidental release of significant quantities of radioactive materials into the atmosphere. Dispersion and associated turbulence and deposition models are reported that account for turbulent diffusion, transfer, and deposition of radioactive pollutants on the earth surface. Short term variation peak-to-mean-ratios are described applied to problems of instantaneous aspects, such as washout of gases in diffusing plumes where nonlinear reactions preclude the use of an average plume description. G.G.

**N73-33045#** World Meteorological Organization, Geneva (Switzerland).
**A STUDY OF THE AGROCLIMATOLOGY OF THE HIGHLANDS OF EASTERN AFRICA**
L. H. Brown and J. Cocheme 1973 218 p refs Prepared in cooperation with Food and Agr. Organ. of the UN, Rome and UNESCO, Paris
(WMO-339; TN-125) Avail: NTIS HC $13.00

The basic climatic potentials of agriculture in areas where more intensive agriculture and the arable land show potentialities for an increase in agricultural production are investigated. The study area is in eastern Africa, and comprises parts of Ethiopia, Kenya, Uganda, and Tanzania. The area is portrayed and the meteorology and climate described under sub areas. It is shown how the seasonal movement of the intertropical convergence zone could bring rain twice a year around the time of the equinoxes at the equator and once a year around the summer solstice near the tropics. Rainfall is the predominant agroclimatological factor, timing being more significant than the availability and the amount. Author (ESRO)

**N73-33046#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
**EFFECT OF FIBRINOGEN CONCENTRATION ON THE RHEODYNAMICAL BEHAVIOR OF HUMAN BLOOD**
Klaus Held 8 Mar. 1973 35 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-54) Avail: NTIS HC $3.75; DFVLR, Porz, West Ger. 12,30 DM

In order to analyze the rheodynamical influence of fibrinogen concentration on the viscosity of human blood, whole blood samples, plasmas, and sera of 25 healthy male subjects were studied in a Couette-type rotational viscometer under shear rates of 45 to 2,620/s. The results point to the extraordinary importance of fibrinogen in the rheological behavior of blood. In the field of shear rates studied, this effect becomes obvious, i.e. there exists an exponential dependence of the viscosity coefficient on fibrinogen concentration. Author (ESRO)

**N73-33047#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
**HEMATOLOGIC STUDIES AFTER RAPID DECOMPRESSION Thesis - Bonn Univ.**
Peter Bangen 4 Apr. 1973 58 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-63) Avail: NTIS HC $5.00; DFVLR, Porz, West Ger. 18,30 DM

The mode of behavior of several hematologic values after rapid decompression was investigated. After specification of the standard physiological values, eighty miniature swine were exposed to rapid decompression ten times at weekly intervals. The following tests on the blood of fifteen animals, showed each time prevailing significant changes in the fields of cell morphology, albumin-chemistry and physiology of coagulation. An attempt is made to explain the factors which may have affected the experimental process. Author (ESRO)

**N73-33048#** School of Aerospace Medicine, Brooks AFB, Tex.
**MIDDLE-EAR MUSCLE REFLEX TO AIRCRAFT NOISE Progress Report, Apr. 1972 - Mar. 1973**
Harrell C. Sutherland, Jr., Roy Danford, Jr., and Donald C. Gasaway Jul. 1973 17 p refs
(AF Proj. 7755)
(AD-764739; SAM-TR-73-20) Avail: NTIS CSCL 06/19

Middle-ear muscle reflex threshold with three types of aircraft noise and with a 1000-Hz pure tone was sought with 21 rated flying personnel. Three subjects failed to respond to the noise at maximum intensity (108-db SPL). Average reflex threshold in db SPL for the other 18 subjects was 94.8 db for the 1000-Hz tone, 95.2 dB for T-37b noise, 98.8 db for UH-1P noise, and 94.4 db for F-4E noise. Threshold for the UH-1P noise was significantly higher than thresholds for the other sounds. No other differences were significant. Threshold SPLs are well within the range of intensities commonly present in aircraft, which suggests that this reflex be considered in any study dealing with the effects of aircraft noise on occupants. Author (GRA)

**N73-33086** Joint Publications Research Service, Arlington, Va.
**FEATURES OF THE BEHAVIOR OF DOGS WHEN GIVEN A CHOICE OF VARIOUS REINFORCEMENTS**
N. V. Asmayan and U. V. Urvayev *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 211-214 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 207-211 (For availability see N73-33053 24-05)

**N73-33069** Joint Publications Research Service, Arlington, Va.
**CORRELATION BETWEEN PRIMARY RESPONSE AND LATE SLOW OSCILLATION OF EVOKED POTENTIAL IN RESPONSE TO LIGHT IN AWAKE AND ANAESTHETIZED RABBITS**
A. I. Shumilina and A. P. Karpov *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 265-278 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 259-271 (For availability see N73-33053 24-05)

**N73-33630** Tetra Tech, Inc., Pasadena, Calif.
**FACTORS AFFECTING LONG RANGE VISION**
Willard H. Wells *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging Aug. 1973 10 p refs (For availability see N73-33619 24-23)

**N73-33631** Tetra Tech, Inc., Pasadena, Calif.
**CRITERIA FOR VISION: RESOLUTION, SIGNAL-TO-NOISE RATIO CONTRAST**
Henri Hodara *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 13 p refs (For availability see N73-33619 24-23)

## 05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

**N73-33049** Houston Univ., Tex.
**A CARDIOVASCULAR CONTROL SYSTEM SIMULATION FOR EXERCISE Ph.D. Thesis**
Ronald Colville Croston 1972 140 p
Avail: Univ. Microfilms Order No. 73-15727

A mathematical model and digital computer simulation of the human cardiovascular system and its controls are developed to simulate transient responses to bicycle ergometer exercise. The purpose of the model is to provide a method to analyze cardiovascular control hypotheses which cannot be easily tested in an animal or human. Complex cardiovascular control hypotheses are derived for the control of heart period, peripheral flow resistances, venous tone, and other controlled variables. Metabolic control models are also derived using simple mathematical models of oxygen up-take, oxygen deficit, and accumulating metabolites to indicate the transient metabolic state and simulate other chemical factors. Results of simulation tests are described for resting conditions, zero load pedaling, and four levels of exercise. Transient response characteristics and steady model values are presented and compared with experimental data. Dissert. Abstr.

**N73-33050** Illinois Univ., Urbana.
**A STUDY OF VISUAL SHAPE PERCEPTION Ph.D. Thesis**
Kiyoshi Maruyama 1972 215 p

Avail: Univ. Microfilms Order No. 73-17314

**Algorithms involved in visual shape perception are studied. The** main interest is to solve the naming problem, i.e., the strategies by which map-like information is transferred to objects of the scene under analysis. The naming problem is specified by two input pictures: a sample picture and a text picture. The problem is to identify and name objects in the given sample picture using name information in the text picture. Once possible individual shape identification has been established, the next step is to consider the structural matching between the given sample and text pictures. Introducing the concept of angularly simple curves and the decomposing of a complex region into simpler classes of regions, basic shape representations for polygonal, pattern sequence, and skeleton representations are given. From these representations both global and local features are extracted to channel to a structural analysis of complex pictures.

Dissert. Abstr.

**N73-33051** New York Univ., N.Y.
**THE EFFECTS OF PHYSICAL FATIGUE ON SEQUENCING IN EYE-HAND COORDINATION PERFORMANCE Ph.D. Thesis**
Howard Gage 1973 172 p
Avail: Univ. Microfilms Order No. 73-19425

The biomechanical profile and its instrumentation are used for objective evaluation of specific aspects of sequencing and integration of major biomechanical elements in eye-hand coordination. Investigated are: (1) The effects on sensory motor performance of physical fatigue induced by a full day of light work; (2) the validity of certain rules of motion performance difficulty established by the Basic Motion Timestudy (BMT) system of predetermined motion times; and (3) the influence of subjects' age on various aspects of sensory motor coordination. Quantitative analyses of the biomechanical profiles show that fatigue adversely affected total performance times for all of the selected test movements. Dissert. Abstr.

**N73-33052*#** McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
**LIFE SUPPORT SYSTEM COST STUDY: ADDENDUM TO COST ANALYSIS OF CARBON DIOXIDE CONCENTRATORS**
M. M. Yakut 30 Sep. 1973 6 p
(Contract NAS8-28377)
(NASA-CR-124462; MDC-G4631) Avail: NTIS HC $3.00 CSCL 06K

New cost data are presented for the Hydrogen-Depolarized Carbon Dioxide Concentrator (HDC), based on modifying the concentrator to delete the quick disconnect valves and filters included in the system model defined in MDC-G4631. System description, cost data and a comparison between CO2 concentrator costs are presented. Author

**N73-33053#** Joint Publications Research Service, Arlington, Va.
**THE MECHANISMS AND PRINCIPLES OF GOAL-DIRECTED BEHAVIOR**
P. K. Anokhin, ed. 21 Sep. 1973 315 p refs transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 296 p
(JPRS-60091) Avail: NTIS HC $17.75

Research is reported which includes: (1) the mathematical description and modeling of goal directed behavior; (2) the experimental investigation of behavioral goal-directed reactions; and (3) the precise neurophysiological study of the mechanisms that effect goal-directed behavior, including motivations and emotions. For individual titles, see N73-33054 through N73-33071.

**N73-33054** Joint Publications Research Service, Arlington, Va.
**A DYNAMIC THEORY OF BEHAVIOR**
G. A. Golitsyn *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 2-31 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 5-33 (For availability see N73-33053 24-05)

A theory of systems is constructed that is considered to be sufficiently general, yet capable of providing effective behavior predictions. The theory involves an initial determination of the variables and the relations of a system. The task of prediction is then dependent upon mathematical expressions of the relations superimposed on the variables. An application of the theory is presented which deals with the dynamic principles of the behavior of animals. D.L.G.

**N73-33055** Joint Publications Research Service, Arlington, Va.
**AN APPROACH TO THE CONSTRUCTION OF A FORMAL MODEL OF BEHAVIOR**
A. L. Shamis and B. Yu. Levit *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 32-47 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 34-49 (For availability see N73-33053 24-05)

The problem of constructing a formal model of behavior is dealt with, and the underlying complexities and limitations are analyzed. A simple mathematical model of optimal behavior in a fixed environment is formulated. However, this model is not adequate to the problem of behavior in a complex multiextremal environment. In order to bring the problem closer to the real situation of decision making by animals in free behavior, the task is considered of extending the model to a complicated environment. Insofar as the complicated environment is probablistic in character, the mathematical expectation of the time at which the system leaves the domain of permissible values is necessarily maximized. It is pointed out that the local principle of decision making may be realized if the problem is reduced to a single-extremum problem by generalization and anticipation. The utilization of a control algorithm is then considered. It is concluded, however, that the real environment in which living organisms function is so complex that the formal application of the algorithm is practically impossible. D.L.G.

**N73-33056** Joint Publications Research Service, Arlington, Va.
**ONE CLASS OF ADAPTIVE SYSTEMS AND RESULTS OF COMPUTER MODELING OF THEIR SELF-INSTRUCTION**
V. A. Yakubovich *In its* the Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 48-77 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 50-79 (For availability see N73-33053 24-05)

An approach is described to the construction of a theory of one special class of adaptive systems. The approach is based on the use of the apparatus of finitely convergent algorithms for solving denumerable systems of inequalities. The approach is applied to the 'grasshopper' adaptive system in which it is assumed that a grasshopper and a target exist on a circular meadow. All of the grasshopper's activity is aimed at catching the next target to jump across the meadow. Since the grasshopper and the target jump simultaneously, in order to catch the target the grasshopper must anticipate where the target will jump at the next instant and then jump to the appropriate point. The anticipation problems solved by the grasshopper's brain are discussed and equations describing the functions are formulated. D.L.G.

**N73-33057** Joint Publications Research Service, Arlington, Va.
**THE EXPEDIENT FUNCTIONING OF AUTOMATA WITH NORMAL AND DISTURBED BEHAVIOR IN EXPERIMENTS ON REINFORCEMENT SELECTION**
N. I. Glazunov, G. Sh. Rozenshteyn, and A. I. Yablonskiy *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60092) 21 Sep. 1973 p 78-90 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 80-92 (For availability see N73-33053 24-05)

Some characteristics are determined for the optimal behavior of models constructed in problems of reinforcement selection. These characteristics are compared with data obtained in similar psychological experiments on healthy and sick human beings. A model is described and analyzed in which the simplest statistical problem of image recognition is considered to be a formal analogue of the psychological experiment on reinforcement selection. A payment function is assigned in the set of solutions to the recognition problem. It is shown that the payment received during the learning of an automaton with disturbed behavior is less than the payment that an automation with normal behavior

receives while learning. Utilizing the described approach, it is possible to introduce quantitative measures of the deviation from the norm in order to construct tests in problems of clinical diagnosis or engineering psychology. D.L.G.

**N73-33058** Joint Publications Research Service, Arlington, Va.
**SIMPLE INDUCTIVE INTERACTION BETWEEN MAN AND OBJECTS AND EVENTS**
L. A. Kozharskiy *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 91-98 ref Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 93-100 (For availability see N73-33053 24-05)

Conventional mathematical methods are used to construct an algorithm of simple inductive interaction between man and his environment. Equations are derived which describe: (1) the collection of information for selection of a decision by the subject, (2) the accumulation of collected information by the subject, and (3) the selection by a subject of a decision on the basis of accumulated information. The algorithm may be utilized in programming problems of medical and technical diagnosis, quantitative and qualitative analysis, isolating information from interference, and other problems for which the selection of a decision is connected with the accumulation of data. D.L.G.

**N73-33059** Joint Publications Research Service, Arlington, Va.
**MODELING COMPLEX BEHAVIOR WITH THE AID OF M-AUTOMATA**
A. M. Kasatkin *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 99-119 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 101-119 (For availability see N73-33053 24-05)

The principles of construction are described of one class of models of intelligent behavior. A modeling language convenient for the constructive representation of the hypothesis was also developed. Hebb-type neuron ensemblies, which are the functional units of the natural nerve net, are considered as the neurophysiological analoques of these models. Artificial systems constructed on the basis of the developed concepts are realized in the form of specific nets. The assemblies of the net are the formal elements that correspond to cortical information models. These assemblies are referred to as i-models, and with the aid of a net of i-models it is possible to represent interconnected systems of images and concepts that are presumably utilized by man in the course of thinking. D.L.G.

**N73-33060** Joint Publications Research Service, Arlington, Va.
**EXPERIMENTAL STUDY OF A MODEL OF MOTOR BEHAVIOR**
L. M. Kasatkina *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 118-140 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 120-142 (For availability see N73-33053 24-05)

A model of purposeful behavior is described which represents a complete nonlearning M automaton. It is designed to reproduce some processes of information processing by the cerebral cortex in the organization of motor behavior. The automaton functions in a certain conditional environment, and the decisions that it makes depend on the results of emotional evaluation and logical processing of information arriving at the automaton's inputs from the environment. A general block diagram of the automaton is presented and the operation of the model is described in detail. D.L.G.

**N73-33061** Joint Publications Research Service, Arlington, Va.
**MODEL OF THE ORGANIZATION OF GOAL-DIRECTED BEHAVIOR**
S. A. Talayev *In its* the Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 141-145 Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 143-147 (For availability see N73-33053 24-05)

The construction and experimental study of functioning models of some complex forms of mental activity are described. Heuristic modeling was chosen as the means of investigation, and an M-network (a network of information models) was selected as the means of realizing the functional model. The initial concept employed considers the brain as a system capable of modeling the subject's external and internal environment. The problem solving process in the planning of motor behavior is considered as the experimental situation. Emphasis is placed on the modeling of perception organization, since perceived information largely determines goals, and the perception of each specific situation depends on the motivation and goals of the proposed behavior. D.L.G.

**N73-33062** Joint Publications Research Service, Arlington, Va.
**THEORETICAL ASPECTS OF MOTIVATIONAL STIMULATION**
K. V. Sudakov and I. M. Sechenov *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 147-168 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 148-167 (For availability see N73-33053 24-05)

A theoretical analysis of motivational stimulation is presented and the following conclusions are made: (1) Each of an organism's needs activates a speific functional system whose activity provides for the satisfaction of the need, which is important to the organism's existence. (2) The significance of motivational stimulation in the activity of various functional systems consists above all in mobilizing the organism to active behavior in the external environment. (3) This mobilization takes place through specific ascending activating influences of need-stimulated motivational centers of the hypothalamus on other sections of the brain. (4) Under different motivations these influences are always emphatically specific and always connect complexes of cortical elements selectively, on the basis of their specific chemical sensitivity. (5) Special goal-directed behavior is formed for each motivation on the basis of precisely such selective connection. D.L.G.

**N73-33063** Joint Publications Research Service, Arlington, Va.
**STRUCTURAL, BEHAVIORAL, AND EEG CORRELATES OF ALIMENTARY MOTIVATION**
K. V. Shuleykina *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 169-199 refs transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 168-195 (For availability see N73-33053 24-05)

A study is described in which alimentary motivation was subjected to a special neurophysiological analysis. The study was aimed at determining the basic objective criteria of motivational stimulation, including structural, behavioral, and electrographic. The work was carried out on 1-month old kittens with permanently implanted electrodes localized in the cortex and subcortical structures. The search for food and the process of eating served as the model forms of behavior. The culmination of the food-search reaction is the moment at which the food is seized. It was found in the study that this moment is the stage of the highest intensiveness of motivational efforts and reflects the decision making process. In recording the electrical activity corresponding to this state, spikes of particularly regular sinusoidal oscillations were observed which often exceeded in amplitude the mean value of the initial search rhythm. It is concluded that these spikes are one case of phase changes in motivational stimulation and correspond to the state of intention to act or decision making. D.L.G.

**N73-33064** Joint Publications Research Service, Arlington, Va.
**USE OF MOTIVATIONAL RELATIONS TO FIND THE ACCEPTOR OF ACTION**
N. V. Asmayan *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 200-204 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 196-200 (For availability see N73-33053 24-05)

A series of experiments was conducted to demonstrate the significance of motivational relations for determining the acceptor of action when an error is present. The experiments were conducted on a dog in which instrumental conditioned reflexes to various reinforcements of two different conditioned stimuli from the same foodbox were developed. In response to a light signal the dog received a water ration upon pressing a lever, and in response to a bell signal the dog received a biscuit

ration. It was found that when hunger and thirst were of identical strength, the dog would accept a substitution of water for biscuits without any negative reaction. However, when thirst was reduced and hunger heightened, the same substitution led to a rejection of the water. Immediately following this the dog was given a light signal and drank the water that it had just rejected. It was concluded that the acceptor of action can be detected in the presence of an error in the form of negative motor reactions only if the stimulus that satisfies the stronger motivation is replaced by a stimulus that satisfies a weak or nearly absent motivation. D.L.G.

**N73-33065** Joint Publications Research Service, Arlington, Va.
**RELATION OF CONDITIONED REACTIONS TO EVALUATION OF RESULTS OF FORTHCOMING REINFORCEMENT**
N. V. Asmayan *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 205-21 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p201-206 (For availability see N73-33053 24-05)

A study was aimed at creating experimental conditions under which negative motor reactions to a conditioned stimulus could be observed. The experiment was conducted on an excitable dog in which instrumental conditioned reflexes were developed in a chamber with two-way reinforcement. Based on the results obtained, the following conclusions were made: (1) Satisfaction of need changes in animal's attitude toward reinforcement from positive to negative. (2) At the same time the animal's attitude changes, the signal significance of the conditioned stimulus changes. This is confirmed by the animal's different reactions to the stimulus when motivation is present and after it has been satisfied. (3) The theory is confirmed that the animal's reaction to the conditioned stimulus is not a purely automatic reflex action, but the result of a complex process of afferent synthesis in which the internal state and the anticipated results of the action are taken into account. D.L.G.

**N73-33066** Joint Publications Research Service, Arlington, Va.
**FEATURES OF THE BEHAVIOR OF DOGS WHEN GIVEN A CHOICE OF VARIOUS REINFORCEMENTS** **c04**
N. V. Asmayan and U. V. Urvayev *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 211-214 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 207-211 (For availability see N73-33053 24-05)

The reaction of voluntary selection was investigated in four dogs. By pressing the righthand lever, in response to a general auditory signal, the animal received a bowl containing biscuits from the righthand foodbox or by pressing the lefthand lever, he received water from the lefthand foodbox. The experiments were conducted after the conditioned reflexes were stabilized. As the motivations declined during the experiment, the latent period of the conditioned instrumental reaction (CIR) increased. At the end of the experiment (after complete satisfaction of hunger and thirst) the dog performed a CIR in response to the conditioning signal but did not accept reinforcement. A CIR did not arise in response to a new stimulus (similar to the conditioning stimulus). When the possibility of performing a CIR was eliminated, the conditioning signal elicited a goal-directed search reaction. Erroneous CIR were corrected with consideration for the attainment of the next stage. Author

**N73-33067** Joint Publications Research Service, Arlington, Va.
**STRUCTURE AND FUNCTIONS OF CENTRAL MECHANISMS OF REINFORCEMENT**
Yu. A. Makarenko *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 215-231 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p212-227 (For availability see N73-33053 24-05)

The data obtained by various researchers on the central mechanisms of reinforcement are summarized. The topics covered include: (1) the topography of reinforcement zones, (2) correlation of central mechanisms of reinforcement upon stimulation of the brain with natural reinforcements, (3) the question of drive reduction or induction, and (4) the existence of separate motivational and reinforcing mechanisms. D.L.G.

**N73-33068** Joint Publications Research Service, Arlington, Va.
**ON VARIOUS TYPES OF CORTICOPETAL INFLUENCES FROM DEEP-SEATED EMOTIOGENIC FORMATIONS OF THE BRAIN**
Ye. M. Bogomolova *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 232-264 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 228-258 (For availability see N73-33053 24-05)

An analysis was conducted, under fixed experimental conditions, of the feature of behavioral emotionally-enhanced reactions that arise in cats upon electrical stimulation of emotiogenic regions of various sections of the mesencephalon, diencephalon, and telencephalon. The results obtained include the following: (1) The emotional reactions that arise on stimulation of the hypothalamus and structures of the mesencephalon are characterized by a low threshold, a short latent period, long duration, and a multiplicity of components. On stimulation of the telencephalic formations of equal force, emotional reactions prove less marked, have a greater latent period, and are distinguished at the height of their development by being transformed into convulsive seizures. (2) On solitary electrical stimulation of these deep-seated emotiogenic brain structures, evoked potentials that reveal the cortical projections of these formations arise at the cerebral cortex. On the basis of these projections it is possible to judge which regions of the cerebral cortex are included in the overall emotiogenic process on stimulation of subcortical emotiotropic structures. D.L.G.

**N73-33069** Joint Publications Research Service, Arlington, Va.
**CORRELATION BETWEEN PRIMARY RESPONSE AND LATE SLOW OSCILLATION OF EVOKED POTENTIAL IN RESPONSE TO LIGHT IN AWAKE AND ANAESTHETIZED RABBITS** **c04**
A. I. Shumilina and A. P. Karpov *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 265-278 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 259-271 (For availability see N73-33053 24-05)

The study was conducted on rabbits with electrodes permanently implanted at 48 points on the surface of the skull. Light bursts were produced by discharges from a flashlamp at the rate of one flash per second and in series of six to eight flashes. The following results were obtained: (1) In an awake rabbit adapted to the experimental conditions, the primary evoked potential (EP) in response to light is recorded most consistently in the visual region of the cortex, while the late slow negative-positive oscillation is generalized throughout the entire cerebral cortex. (2) Simultaneous application of light and a painful stimulus causes the primary response to be generalized beyond the projective region and the late slow oscillation to be suppressed in the cortex and subcortical formations. (3) The administration of a tranquilizer changes the configuration of the positive components of the primary response and the late slow oscillation of the EP in response to light. (4) The administration of stem-localized narcotics causes redistribution of the pathways of the ascending subcortical activations. D.L.G.

**N73-33070** Joint Publications Research Service, Arlington, Va.
**THE ORIENTATIVE-INVESTIGATIVE REACTION AS A FACTOR CHANGING THE CONFIGURATION OF EVOKED POTENTIALS ON REPEATED FLASHES**
M. V. Serbinenko *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 279-291 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 272-281 (For availability see N73-33053 24-05)

Experiments were conducted on awake rabbits with electrodes implanted epidurally into the sensomotor, temporal, and occipital regions of the cortex, the corpus geniculatum laterale, the hippocampus, and other brain formations. During the experiments, it was observed that a defense state, manifested in stepped-up respiration with an increase in inspiratory dyspnea during the period of the light flashing, appears at first. Then generalized desynchronization is recorded on the EEG in the anterior regions of the cortex. Evoked potentials appear irregularly and are represented primarily by the primary response in the occipital and temporal cortex. After several dozen flashes, vegetative

reactions fade, the EEG becomes less active, and this usually coincides with the appearance of the elicited responses that include a two-phase component. It was concluded from the experiments that changes in the evoked potentials, under the influence of monotonous stimulation, are most often manifested in a reduction of amplitude and the depression of late components of the visual response, while the primary response is altered less noticeably. D.L.G.

**N73-33071** Joint Publications Research Service, Arlington, Va.
**CROSS-CORRELATION ANALYSIS OF STRESS RHYTHM DURING ACTION OF STIMULI OF DIFFERENT BIOLOGICAL SIGNIFICANCE**
A. M. Mamedov *In its* The Mech. and Principles of Goal-Directed Behavior (JPRS-60091) 21 Sep. 1973 p 292-302 refs Transl. into ENGLISH of the book "Mekhanizmy i Printsipy Tselenapravlennogo Povedeniya" Moscow, Izd-vo Nauka, 1972 p 282-290 (For availability see N73-33053 24-05)

Experiments were conducted with unanesthetized rabbits with electrodes permanently implanted in various regions of the cerebral cortex and subcortical structures. The results of cross-correlation analysis of the stress rhythm during stimuli of varying biological quality showed the presence of phase shifts of different magnitude, reaching one half-period. In combination with the high functional relation between relatively remote anatomical structures of the brain, these phase shifts which turned up in the frequency of the periodic component, provide grounds to consider stress rhythm as an expression of cortico-subcortico reverberation of stimulation. D.L.G.

**N73-33072*#** Linguistic Systems, Inc., Cambridge, Mass.
**THE ROLE OF WATER TEMPERATURE IN BRADYCARDIA DURING FACIAL IMMERSION**
J. Corriol and J. J. Rohner Washington NASA Oct. 1973 15 p refs Transl. into ENGLISH from Arch. Sci. Physiol. (France), v. 22, 1968 p 265-274
(Contract NASw-2482)
(NASA-TT-F-15025) Avail: NTIS HC $3.00 CSCL 06S

The role is investigated of variations in water temperature upon bradycardia, or stimulus-induced cardiac deceleration. This phenomenon occurs as a reflex when the human face is immersed in water. Using twelve test subjects, the authors carry out facial immersions at various water temperatures, accompanied by accurate electrocardiographic measurement. Through statistical analysis, the effect of water temperature variations upon the bradycardia reflex is demonstrated. The nature of the cutaneous receptors involved in the reflex is also discussed. Author

**N73-33073*#** Techtran Corp., Glen Burnie, Md.
**FUNCTIONAL DISTURBANCES DURING HYPOKINESIA IN MAN**
L. I. Kakurin, B. S. Kamkovskiy, V. S. Georgiyevskiy, Yu. N. Purakhan, M. A. Cherenikhin, B. M. Mikhaylov, B. N. Pemukhov, and Ye. N. Buryikov Washington NASA Oct. 1973 11 p refs Transl. into ENGLISH from Vop. Kurortol., Fizioter, Lech. Fiz. Kul't. (USSR), v. 35, 1970 p 19-24
(Contract NASw-2485)
(NASA-TT-F-15148) Avail: NTIS CSCL 06S

Two groups of three male volunteers each were confined to strict bed rest for 20 days. Group 2 performed exercises while in bed while group 1 did not; the members of the latter group showed a greater incidence of a neuroasthenic syndrome as well as more profound changes in circulatory parameters. Hence, physiological systems deteriorate with diffuse and this phenomenon must be taken into account when prescribing prolonged periods of bed rest. Author

**N73-33074*#** Linguistic Systems, Inc., Cambridge, Mass.
**RETINAL ADAPTATION**
H. Lagrange Washington NASA Oct. 1973 28 p refs Transl. into ENGLISH from Ann. Ocul. (Paris), v. 167, 1930 p 404-426
(Contract NASw-2482)
(NASA-TT-F-15036) Avail: NTIS HC $3.50 CSCL 06S

A review is presented concerning retinal adaptation to varying light intensity. It enters into the anatomical and physiological substrate of adaptation, with a detailed discussion of how adaptation varies with the different light wavelengths. The retina is divided into different zones of sensitiveness and their mechanism and a physiological model is explained. Visual acuity is gone into in depth, and clinical case material is used to support some of the physiological models. Author

**N73-33075#** Illinois Univ., Savoy.
**ENHANCEMENT OF HUMAN EFFECTIVENESS SYSTEM DESIGN, TRAINING, AND OPERATION Annual Progress Report, 1 Jul. 1972 - 30 Jun. 1973**
Charles O. Hopkins Jul. 1973 36 p refs
(Contract F44620-70-C-0105; AF Proj. 9778)
(AD-764761; ARL-73-14/AFOSR-73-9; AFOSR-73-1253TR)
Avail: NTIS CSCL 05/10

The research reported consists of eight tasks, four concerned with manned systems research and four with human resources research. Although each task is basic in the sense that it seeks results of a broadly generalizable nature, each is specifically relevant to one or more well-known and long-standing Air Force problems. (Modified author abstract) GRA

**N73-33015** Joint Publications Research Service, Arlington, Va.
**PRINCIPAL CHARACTERISTICS OF A METHOD FOR REGENERATING THE OXYGEN IN PRESSURIZED CHAMBERS BASED ON ELECTROLYSIS WITH USE OF SOLID ELECTROLYTES**
B. G. Grishayenkov, N. G. Zorina, and S. V. Devyatov *In its* Space Biol. and Med., Vol. 7, No. 4, (JPRS-60248) 10 Oct. 1973 p 1-4 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 3-5 (For availability see N73-33014 24-04)

**N73-33025** Joint Publications Research Service, Arlington, Va.
**INVESTIGATION OF THE POSSIBILITY OF RECORDING THE HUMAN ELECTROENCEPHALOGRAM UNDER THE INFLUENCE OF MUSCLE NOISE**
L. N. Nikolskiy and R. A. Vartbaronov *In its* Space Biol. and Med., Vol 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 65-70 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 43-47 (For availability see N73-33014 24-04)

**N73-33026** Joint Publications Research Service, Arlington, Va.
**ANALYSIS OF SOME INDICES OF ELECTRONYSTAGMOGRAMS FOR HEALTHY PERSONS IN LABYRINTHAL CALORIZATION TESTS**
D. Bodo, V. P. Baranova, E. I. Matsnev, and I. Ya. Yakovleva *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 71-76 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 47-51 (For availability see N73-33014 24-04)

**N73-33035** Joint Publications Research Service, Arlington, Va.
**METHOD FOR AUTOMATIC PROCESSING OF THE INDICES OF AN OPERATOR'S GAS EXCHANGE DURING WORK IN A TRAINER USING A "DNEPR" ELECTRONIC COMPUTER**
V. M. Baranov, M. M. Skvortsov, V. I. Grachev, and A. B. Shneyerov *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248 10 Oct. 1973 p 133-135 Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 86-88 (For availability see N73-33014 24-04)

**N73-33037** Joint Publications Research Service, Arlington, Va.
**WORK OF THE AEROSPACE SECTION OF THE LENINGRAD SOCIETY OF PHYSIOLOGISTS, BIOCHEMISTS AND PHARMACOLOGISTS IMENI I. M. SECHNOV**
G. I. Gurvich, E. V. Bondarev, and V. A. Yegorov *In its* Space Biol. and Med., Vol. 7, No. 4 (JPRS-60248) 10 Oct. 1973 p 138-140 Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 4, Jul. - Aug. 1973 p 90-91 (For availability see N73-33014 24-04)

**N73-32960*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**FACTORS INFLUENCING PUBLIC ACCEPTANCE OF STOL NOISE**
Philip M. Edge, Jr., Jimmy M. Cawthorn, and Clemans A. Powell, Jr. *In its* STOL Technol. 1972 p 353-365 refs (For availability

see N73-32934 24-02)
CSCL 05E

# 06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

**N73-33076*** Peninsular ChemResearch, Inc., Gainesville, Fla.
**HIGHLY FLUORINATED POLYURETHANES Patent**
Eugene C. Stump and Stephen Eugene Rochow, inventors (to NASA) Issued 28 Aug. 1973 4 p Filed 4 Apr. 1972 Continuation-in-part of abandoned US Patent Appl. SN-770417, filed 24 Oct. 1968 Sponsored by NASA
(NASA-Case-NPO-10767-1; US-Patent-3,755,265; US-Patent-Appl-SN-241061; US-Patent-Class-260-77.5AP; US-Patent-Appl-SN-770417) Avail: US Patent Office CSCL 07C

The reaction perfluorinated hydroxyl terminated polyether with diisocyanate to form polyurethane is discussed. Data are given on the resin's oxidation stability, chemical resistance, and low temperature flexibility. Official Gazette of the U.S. Patent Office

**N73-33077** Yale Univ., New Haven, Conn.
**RAMAN, RESONANCE RAMAN, AND FLUORESCENCE STUDIES IN GASES Ph.D. Thesis**
Daniel Gene Fouche 1973 148 p
Avail: Univ. Microfilms Order No. 73-16774

This work is concerned with inelastic light scattering from molecular gases, with applications to the remote detection of air pollutants. The theory of five processes - ordinary Raman scattering, resonance Raman scattering, off-resonance fluorescence, resonance fluorescence, and broad fluorescence - is reviewed in terms of a Kramers-Heisenberg-type dispersion equation. The dependence of the scattered intensity on the laser photon energy, pressure, laser spectral distribution, and Doppler velocities of the gas is discussed. Experiments were done with an argon-ion laser, 90 deg scattering geometry, spectrometer, and photomultiplier tube. Dissert. Abstr.

**N73-33078** Rubber and Plastics Research Association of Great Britain, Shrewsbury (England).
**EXPERIMENTAL APPRAISAL OF RHEOLOGICAL EQUATIONS OF STATE FOR POLYMER MELTS. 2: ELASTIC RECOVERY**
J. Batchelor Sep. 1972 9 p refs
(RR-203) Copyright. Avail: Issuing Activity

Predictions of the OWFS, WJFLMB, and Kaye rheological equations of state are compared with constrained shear recovery results obtained for two polyisobutylenes. The model parameters determined from the steady state measurements were used to calculate theoretical predictions. Results show that the WJFLMB and Kaye models are in reasonable agreement with the experiment. However, neither model describes the form of recovery well. The OWFS model is clearly unsuitable for predicting recovery results. Author

**N73-33079** Wisconsin Univ., Madison.
**THE USE OF LAMINAR DISPERSION IN CAPILLARIES TO MEASURE BINARY DIFFUSIVITIES Ph.D. Thesis**
Jacob Braslaw 1973 286 p
Avail: Univ. Microfilms Order No. 73-15956

The use of laminar dispersion in a capillary tube to measure binary diffusion coefficients over wide temperature and pressure ranges is investigated. The effects of initial solute pulse shape, free convection, coiled tubes, and stagnant pockets along the fluid path are also considered. A system has been designed and built to measure binary diffusivities over a wide temperature and pressure ranges. The system features a double Michelson interferometer for measurement of composition changes and a simple injection valve for introduction of solute at pressures up to 10,000 psia and temperatures up to 400 C. Diffusivities of ethane in methane at 298 K and pressures up to 2000 psia are reported. Dissert. Abstr.

**N73-33080** Texas Univ., Austin.
**LOW TEMPERATURE RECOMBINATION AND TRAPPING ANALYSES IN HIGH PURITY GALLIUM ARSENIDE BY MICROWAVE PHOTODIELECTRIC TECHNIQUES Ph.D. Thesis**
Moiz Badrudin Khambaty 1972 149 p
Avail: Univ. Microfilms Order No. 73-18448

High purity epitaxial GaAs has been studied by photodielectric as well as photoconductivity, Hall effect, and related methods. Irradiation by He-Ne laser light at liquid helium temperatures generated hot electrons in GaAs. A non-contact PD version of the well known thermally stimulated technique is introduced, by which shallow donor-traps were located at 0.005 eV below the conduction band, in agreement with least-squares-fit to Hall effect data. A combination of techniques is used to identify two major centers active at low temperatures: shallow residual donors 0.005 eV from the conduction band acting as traps and becoming recombination centers on cooling to the helium range, and deeper residual acceptors approximately 0.003 eV from the valence band, acting as potent hole traps. Dissert. Abstr.

**N73-33081*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**FLAMMABILITY OF MATERIALS IN GASEOUS OXYGEN ENVIRONMENTS**
C. F. Key, J. G. Austin, and J. W. Bransford Sep. 1973 86 p refs
(NASA-TM-X-64783) Avail: NTIS HC $6.50 CSCL 07D

The results of evaluation of a wide variety of materials and configurations to determine their flammability characteristics in gaseous oxygen environments are reported. Author

**N73-33082*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**RADIOLYTIC PREPARATION OF ANHYDROUS TIN (2) CHLORIDE**
Warren H. Philipp and Stanley J. Marsik Washington Oct. 1973 13 p refs
(NASA-TM-X-2927; E-7511) Avail: NTIS HC $2.75 CSCL 07D

Anhydrous tin (2) chloride ($SnCl_2$) is prepared by radiolysis with high energy electrons of a tin (4) chloride ($SnCl_4$) solution in heptane. The $SnCl_4$ is reduced to insoluble $SNCl_2$. The energy yield, $G(SnCl_2)$, molecules of $SnCl_2$, produced per 100 eV, increases with $SnCl_4$ concentration from 1.6 at 0.15 M $SnCl_4$ to 3.1 at 3.0 M $SnCl_4$. Other parameters such as temperature total dose and beam current have little influence on $G(SnCl_2)$. The method may be used to prepare other metal halides if the higher valence, more covalent metal halide is soluble in aliphatic hydrocarbons and the lower more ionic metal halide is insoluble. The reaction mechanism is discussed; the radiolysis of both heptane and $SnCl_4$ is involved. At high $SnCl_4$ concentration $G(SnCl_2)$ appears to be limited by the yield of SnC13 radicals. Author

**N73-33083*#** Rockwell International Corp., Anaheim, Calif.
**INVESTIGATION OF CHEMICAL VAPOR DEPOSITION OF GARNET FILMS FOR BUBBLE DOMAIN MEMORIES**
P. J. Besser and T. N. Hamilton Oct. 1973 102 p refs
(Contract NAS1-11446)
(NASA-CR-132325) Avail: NTIS HC $7.25 CSCL 07D

The important process parameters and control required to grow reproducible device quality ferrimagnetic films by chemical vapor deposition (CVD) were studied. The investigation of the critical parameters in the CVD growth process led to the conclusion that the required reproducibility of film properties cannot be achieved with individually controlled separate metal halide sources. Therefore, the CVD growth effort was directed toward replacement of the halide sources with metallic sources with the ultimate goal being the reproducible growth of complex garnet compositions utilizing a single metal alloy source. The characterization of the YGdGaIG films showed that certain characteristics of this material, primarily the low domain wall energy and the large temperature sensitivity, severely limited its potential as a useful material for bubble domain devices. Consequently, at the time of the change from halide to metallic sources, the target film compositions were shifted to more useful materials such as YGdTmGaIG, YEuGaIG and YSmGaIG. Author

**N73-33084*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**IN SITU POLYMERIZATION OF MONOMERS FOR POLYPHENYLQUINOXALINE/GRAPHITE**
Tito T. Serafini, Peter Delvigs, and Raymond D. Vannucci [1973] 15 p refs Proposed for presentation at 29th Ann. Soc. of the Plastics Ind., Reinforced Plastic Composites Conf., Washington, D. C., 4-8 Feb. 1974
(NASA-TM-X-71454; E-7732) Avail: NTIS HC $3.00 CSCL 07C

Methods currently used to prepare fiber reinforced, high temperature resistant polyphenylquinoxaline (PPQ) composites employ extremely viscous, low solids content solutions of high molecular weight PPQ polymers. An improved approach, described in this report, consists of impregnating the fiber with a solution of the appropriate monomers instead of a solution of previously synthesized high molecular weight polymer. Polymerization of the monomers occurs in situ on the fiber during the solvent removal and curing stages. The in situ polymerization approach greatly simplifies the fabrication of PPQ graphite fiber composites. The use of low viscosity monomeric type solutions facilitates fiber wetting, permits a high solids content, and eliminates the need for prior polymer synthesis. Author

**N73-33085#** California Univ., Livermore. Lawrence Livermore Lab.
**SIMULTANEOUS DETERMINATION OF CARBON, HYDROGEN, AND NITROGEN IN ORGANIC COMPOUNDS**
R. K. Stump and J. W. Frazer 18 Jan. 1973 7 p refs
(Contract W-7405-eng-48)
(UCID-16198) Avail: NTIS HC $3.00

A simple analyzer incorporating a variable-temperature condensation trap and operating under computer control was constructed for C, H, and N determination in organic compounds. This system requires little maintenance and eliminates the usual problems associated with an elaborate glass vacuum apparatus. Results are accurate within acceptable limits with a relative standard deviation of + or - 0.10%. Author (NSA)

**N73-33086#** Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
**MEASUREMENT OF VISCOSITY OF SOLUTION OF He 3 IN He 4 AT SUPERLOW TEMPERATURES**
N. S. Borisov, B. S. Neganov, and G. Feller 1973 13 p refs In RUSSIAN
(JINR-P8-7009) Avail: AEC Depository Libraries HC $3.00

Viscosity of 6.4% of He-3 in He-4 was measured for the temperature range 8 to 10 mK. The temperature drop (which is due to viscose heating in the process) at the capillary ends was measured by two thermometers. It was found that if viscosity conforms to the law eta = alpha T to the minus second power, then Alpha = 5.3 x 10 to the minus 7th power P grad to the second power. Author (NSA)

**N73-33087#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**CORROSION OF TYPE 304L STAINLESS STEEL AND HASTELLOY IN N BY MIXTURES OF BORON TRIFLUORIDE, AIR, AND ARGON**
J. W. Koger Dec. 1972 18 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4172) Avail: NTIS HC $3.00

Corrosion of type 304L stainless steel and Hastelloy N was studied in gaseous mixtures of BF3, air, and argon at 600, 300, and 200 C. In some tests the alloy specimens and gases were in contact with molten fluoride mixtures. At 600 C under air, specimens of both alloys were completely destroyed in both fuel salt and fluoroborate salt mixtures. No significant weight changes were measured for Hastelloy N immersed in salt exposed to argon or BF3, but type 304L stainless steel lost weight under the same conditions. This weight loss was greater under BF3 than under argon and greater in the fluoroborate mixture than in the fuel salt. With no salt immersion, the various gases produced very small changes in the alloys at 200 C.
Dissert. Abstr.

**N73-33088#** United Kingdom Atomic Energy Authority, Harwell (England).
**HETEROGENEOUS DECOMPOSITION OF ACETONE BY A 20 PERCENT Cr-25 PERCENT Ni-Nb STABILIZED AUSTENITIC STAINLESS STEEL AND OTHER MATERIALS. PART 1: KINETICS AND DEPOSIT CHARACTERIZATION**
M. J. Bennett, G. H. Chaffey, A. J. Langford, and D. R. V. Silvester Apr. 1973 85 p refs
(AERE-R-7407) Avail: AEC Depository Libraries HC $6.25; HMSO £ 1.50; PHI $5.80

The kinetics of carbon deposition from acetone on 20% Cr/25% Ni niobium stablized stainless steel and other materials were studied at temperatures between 400 and 800 C. The individual reactions were classified broadly into three groups. In the first, there had been least deposition, the substrate was unchanged and had directly catalyzed acetone decomposition. The solid products in the second group of reactions with more reactive materials were also primarily carbonaceous, however, in addition they contained inorganic constituents derived from the substrate, which participated in the mechanism by which carbon was formed. In the third group, the oxides were also reduced, but the subsequent extent of carbon formation was slight. Among these reactions the most active elements in promoting deposition were iron and nickel. NSA

**N73-33089#** United Kingdom Atomic Energy Authority, Harwell (England).
**HETEROGENEOUS DECOMPOSITION OF ACETONE BY A 20 PERCENT Cr-25 PERCENT Ni-Nb STABLIZED AUSTENITIC STAINLESS STEEL AND OTHER MATERIALS. PART 2: INHIBITION BY SULFUR POISONING**
M. J. Bennett, G. H. Chaffey, B. L. Myatt, and D. R. V. Silvester Mar. 1973 18 p refs
(AERE-R-7408) Avail: AEC Depository Libraries HC $3.00; HMSO 50p; PHI $2.15

The inhibition of carbon deposition from acetone onto 20%Cr/25%Ni/Nb stainless steel, Fe3O4 and Cr2O3 by sulfinding and by the continous addition of sulfur compounds to the gas phase was studied. The gaseous poisons examined were thiophene, hydrogen sulfide, sulfur dioxide, and carbonyl sulfide and their relative effectiveness was established over a wide range of partial pressures. Sulfur poisoning reduced, and in some instances prevented, the deposition on Fe3O4. The gaseous poisons also inhibited deposition by their adsorption on catalytic sites in preference to acetone. Author (NSA)

**N73-33090#** Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et de ses Applications Spatiales.
**AUTOMATIC UNITARY CHEMICAL OPERATIONS (ABSORPTION COLUMNS, FLUIDIZED BED PROCESSORS, CONTINUUM FERMENTATION): MODELS AND INSTRUMENTATION Annual Report [CONDUITE AUTOMATIQUE D'OPERATIONS CHIMIQUES UNITAIRES (COLONNE D'ABSORPTION, REACTEUR EN LIT FLUIDISE, FERMENTATION EN CONTINU). MODELISATION INSTRUMENTATION. RAPPORT ANNUEL D'ACTIVITE]**
Y. Sevely (Toulouse Univ.) 15 Dec. 1972 16 p In FRENCH
(Contract DGRST-70-01-50)
(LAAS-Publ-975) Avail: NTIS HC $3.00

Processes for automatic control of three pilot chemical production units are presented. For the amine absorption column an external dynamical mathematical simulation model based on input concentration stepwise variations was developed. On-line utilization is not possible but single optimal strategies, using feed forward control and an algorithm for decoupling of the output variables (concentration and flow) can be stored in the computer memory. For the vinyl acetate fluidized bed processor, an algorithm for identification of the diffusion and vacuum coefficients was defined but is not liable to extrapolate on-line far from the fluidization threshold. On-line mass spectrography measurements of the reaction compounds requires one to two seconds. Pure acetic acid, a new catalyst support, and CO2 trapping were required to reach correct performance of the unit. The optimal working point conditions for the third unit (enzymatic saccharose oxydation into gluconic acid by aerobic growth of pseudomonax fluorescence) are described together with the corresponding mathematical model. A list of on-line and off-line measured parameters is given. Future applications to protein production are mentioned. ESRO

N73-33091# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
**STUDIES OF THE BREAKDOWN MECHANISM OF POLYMERS. 8: THE THERMAL DECOMPOSITION OF A POLY TETRAAZOLATE, TRIAZOLE, OXATHIAHYDRAZIDE, THIADIAZOLE, AND THIAZOLE**
Gerhard F. L. Ehlers, Kurt R. Kisch, and Wilbert R. Powell Mar. 1973 49 p refs
(AF Proj. 7340)
(AD-764720; AFML-TR-72-262) Avail: NTIS CSCL 07/3

A poly(phenylene)imino tetraazolate, a poly N-phenyl-triazole, a polyoxathiahydrazide, a polythiadiazole, and a polydithiazole were subjected to decomposition in vacuum at temperatures up to 620C, and the decomposition mechanisms postulated on the basis of the mass spectroscopic data of the volatiles and the mass spectral, infrared, and elemental analysis of condensibles and residues. A summary of the proposed mechanisms is given. Author (GRA)

N73-33092# Hawaii Inst. of Geophysics, Honolulu.
**PRESSURE AND TEMPERATURE STUDIES OF GLASS PROPERTIES RELATED TO VIBRATIONAL SPECTRA Technical Report, Feb. 1972 - 31 Jan. 1973**
Murli H. Manghnani Jul. 1973 36 p refs
(Contract N00014-67-A-0387-0012; NR Proj. 032-527)
(AD-764891; TR-3) Avail: NTIS CSCL 07/4

Infrared absorption spectra of five lithium silicate and six potassium silicate glasses of varying composition (20 to 25 mole % $Li_2O$, and 15 to 40 mole % $K_2O$, respectively) are examined in the range 1500 to 100/cm. The frequencies of the main absorption bands decrease with an increase of alkali metal oxide ($M_2O$) content, with the exception of the about 960/cm shoulder for the lithium silicate glasses. The pressure dependences to about 40 kbar, of all the main infrared absorption frequencies, which are pressure-sensitive, are found to be positive. The effects of pressure were found to be opposite to the compositional effects. Gruneisen mode gammas evaluated from the pressure dependence of the infrared absorption frequencies are apparently related to the polarizing power of the alkalimetal ion. The results are discussed in light of previous high-pressure infrared absorption studies of fused silica and sodium silicate glasses. (Modified author abstract) GRA

N73-33093# Southampton Univ. (England). Dept. of Chemistry.
**THE APPLICATION OF SPECTROSCOPY TO NON-EQUILIBRIUM ENERGY DISTRIBUTIONS PRODUCED IN DISTURBED AND CONTAMINATED ATMOSPHERES Interim Scientific Report, 1 Feb. 1972 - 31 Jan. 1973**
Neville Jonathan Apr. 1973 11 p refs
(Grant AF-AFOSR-2276-72; AF Proj. 8658)
(AD-764813; AFCRL-TR-73-0336; ISR-1) Avail: NTIS CSCL 07/4

The report describes research leading to measurement of the energy level populations for vibrationally and rotationally excited hydrogen fluoride formed during simple atom-molecule reactions. Trajectory calculations using LEPS surfaces and infrared chemiluminescence techniques have been employed. Some studies of the high resolution photoelectron spectra of transient species are also described. Author (GRA)

N73-33094# Georgia Univ., Athens.
**INTERNATIONAL SYMPOSIUM ON CHEMILUMINESCENCE Final Report**
Milton J. Cormier, David M. Hercules, and John Lee Aug. 1973 17 p refs Symp. held at Athens, Ga., 10-13 Oct. 1972
(Grant DA-ARO(D)-31-124-72-G124)
(AD-765525; UGA-15C-1; AROD-10397-1-C) Avail: NTIS CSCL 07/4

Briefly described is the International Symposium on Chemiluminescence, held at the University of Georgia on October 8-13, 1972. The article includes a list of papers presented and the text of a general introductory article on the mechanisms of chemi- and bioluminescence. GRA

N73-33095# Army Foreign Science and Technology Center, Charlottesville, Va.
**EFFECT OF MASS TRANSFER ON HEAT TRANSFER DURING EVAPORATION OF A LIQUID FROM AN EXPOSED SURFACE IN A RAREFIED GAS ATMOSPHERE**
V. I. Balakhonova, P. A. Nokikov, and V. M. Subach 13 Mar. 1973 10 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Belorussia SSR), no. 3, 1971 p 405-410
(AD-765527; FSTC-HT-23-2000-72) Avail: NTIS CSCL 07/4

The evaporation of a liquid from an open surface was investigated. The mechanism of the effect of mass transfer on heat transfer for vaporization in free convection was established on the basis of an experimental study. GRA

# 07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

**N73-33096** Rhode Island Univ., Kingston.
**STABILITY OF PROPAGATION SYSTEMS Ph.D. Thesis**
Brian Norman Belanger 1973 147 p
Avail: Univ. Microfilms Order No. 73-16732

This thesis examines the dynamic behavior and develops criteria for the spatial and temporal stability classification of one-dimensional linear distributed parameter systems whose solutions represent waves. The systems are described either by a set of first-order partial differential equations (state description) or a single higher-order equation. Spatial classification involves analyzing the properties of the characteristic impedance which is incorporated in the eigenvector solutions of the state description. Since the state description is not always available, extraction of spatial information from the dispersion equation is desired. Previous discrepancies and inconsistencies in temporal definitions are corrected and clarified. Dissert. Abstr.

**N73-33097** British Broadcasting Corp., Kingswood (England). Research Dept.
**SATELLITE BROADCASTING: BANDWIDTH REQUIREMENTS FOR F.M. TELEVISION SIGNALS**
N. H. C. Gilchrist Sep. 1973 12 p refs
(BBC-RD-1973/19) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The rf bandwidth is evaluated that is required to transmit, with an acceptably low level of distortion, 625-line Standard I PAL color television signals by frequency modulation with various values of modulation index. Described are measurements made on a proposed subcarrier sound system, and an examination of the performance of a fm television system near the noise threshold. Values for bandwidth and deviation are recommended for fm television broadcasting (including the sound signal) from satellites. Author

**N73-33098** Illinois Univ., Urbana.
**ON SEQUENTIAL COMMUNICATION SCHEMES WITH INFORMATION FEEDBACK Ph.D. Thesis**
Abidin Turgay Ural 1972 128 p
Avail: Univ. Microfilms Order No. 73-17456

Two feedback communication schemes with an upper bound on the maximum decision time are analyzed. The first scheme is a sequential system with constant antipodal signaling. In addition to the decision feedback channel, an information feedback channel is used for energy saving. The performance of this scheme is derived for both the noiseless and the noisy feedback channels. Two of the existing systems may be obtained as limiting cases of the combined scheme considered here. An M-ary sequential scheme with intermittent information feedback is also considered. The signals are assumed to be mutually orthogonal over a set of discrete subintervals of the maximum transmission period. It has been shown that both schemes provide a better performance than the corresponding sequential and the nonsequential schemes at the expense of increased signal peak power. Dissert. Abstr.

**N73-33099** Illinois Univ., Urbana.
**ON THE STATISTICAL MODELING OF RADAR TARGETS Ph.D. Thesis**

James Wilbur Wright 1972 137 p
Avail: Univ. Microfilms Order No. 73-17483

Techniques and procedures for computing the statistical characteristics of some electromagnetic scattering phenomena from radar targets are developed. Radar measurements are perturbed by electromagnetic scattering phenomena induced by complex targets including radar cross section scintillation and glint or position error. The statistical characteristics of these phenomena are used to evaluate radar system performance, develop optimum tracking systems, and develop stochastic models to use in system simulations. Dissert. Abstr.

**N73-33100** British Broadcasting Corp., Kingswood (England). Research Dept.
**AN INVESTIGATION INTO A PROPOSAL FOR A SIMPLIFIED TELEVISION FIELD SYNCHRONISING SIGNAL**
G. M. LeCouteur 1973 25 p refs
(BBC-RD-1973/20) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A simplification of the television field synchronization signal by reducing its duration so as to leave more time in the field blanking interval for the transmission of data is reported. Resistance to interference remained substantially unaffected when using this form of synchronizing signal; but a small number of receivers suffered impairment of interlace when operating on the proposed signal. Author

**N73-33101** British Broadcasting Corp., Kingswood (England). Research Dept.
**DIGITAL TRANSMISSION CODES: PRELIMINARY INVESTIGATION OF HDB3 AND RELATED TERNARY CODES FOR BROADCAST SIGNAL DISTRIBUTION**
T. A. Moore Sep. 1973 12 p
(BBC-RD-1973/21) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The use of HDB3 as the proposed customer interface code in the Post Office digital communication network is studied. HDB3 is a three level transmission code with no dc component and with a bound on the maximum number of successive equilevel symbols. These two characteristics are important since ac coupling may then be employed in the transmission path and virtually continuous timing information can be extracted from the coded signal. The properties of related transmission codes, including the class of alphabetic codes were also investigated, in view of the likely adoption of one of these by the Post Office as a line transmission code at the higher bit rates. The effect of transmission code digit errors on the decoded binary sequence was studied and suitable error correction schemes are outlined. An experimental HDB3 code was constructed, primarily to demonstrate the feasibility of such transcoding at bit rates up to the order of 20 Mb/s, using commercially available integrated circuits. Author

**N73-33102** Northeastern Univ., Boston, Mass.
**THE CHARACTERIZATION OF MULTIPATH AND DOPPLER FADING IN EARTH SCATTER COMMUNICATION, NAVIGATION, AND RADAR LINKS Ph.D. Thesis**
Joseph Kenneth DeRosa 1972 207 p
Avail: Univ. Microfilms Order No. 73-18385

The characteristics are given for the multipath and Doppler-spread class of communication and radar systems in terms of the statistical and electrical properties of the scattering surface, the geometry of the link, and the properties of the receiving and transmitting antennas. Specifically, the earth scatter portion of the channel is analyzed from both the phenomenological (input-output) point of view of the communication theorist and the physical point of view of the propagation physicist. The scattering surface is modeled as a two-dimensional spatial stochastic process with two discernible scales of roughness and an arbitrary complex dielectric constant. Finally the results of a computer simulation applied to a typical satellite-to-aircraft link for an SST flight path over the North Atlantic are presented to demonstrate the application of the theory. Dissert. Abstr.

**N73-33103** Maryland Univ., College Park.
**PROPAGATION OF RANDOM ELECTROMAGNETIC WAVES Ph.D. Thesis**
Danai Lekhyananda 1972 115 p
Avail: Univ. Microfilms Order No. 73-18253

The propagation of an electromagnetic wave is studied which has suffered changes of phase and amplitude in its passage through a randomizing medium such as a turbulent dielectric. Expressions are derived for the (n)th-order autocorrelation and spectrum of intensity fluctuations in terms of the (2n)th-order mutual coherence function on the initial plane. Simple expressions are obtained when the wave is initially weakly phase distributed. The probability distribution of intensity fluctuations is shown to be Gaussian in this case. Next, a physically justifiable model for the phase autocorrelation function is derived employing ray optics. This relates the phase variations on the initial plane to the refractive index variations which are assumed to be Kolmpgorov distributed. The variance of intensity fluctuations using this model are then calculated numerically. The results are compared to those obtained assuming a Gaussian phase autocorrelation. The results obtained display the limitations of the weak phase screen approximation. Dissert. Abstr.

**N73-33104** Utah Univ., Salt Lake City.
**A PRIORI DIGITAL SPEECH ANALYSIS Ph.D. Thesis**
Steven Frank Boll 1973 117 p
Avail: Univ. Microfilms Order No. 73-19054

A method is described which takes advantage of the quasi-periodic nature of voiced speech sounds to reduce the amount of computation needed to obtain the analysis parameters. The vocal tract is modeled as an all-pole digital filter (predictive coding) and pitch is detected using a modified autocorrelation method. Since voiced speech is quasi-periodic, its waveform is characterized by a high degree of redundancy from pitch period to pitch period. For these regions, the parameters which describe the mathematical voice model are relatively constant. Specifically, the predictor coefficients and the pitch period vary slowly enough in these regions to allow their preceding values to be used as additional a priori information when calculating their present values. Estimates of the predictor coefficients are obtained using a priori least squares. By incorporating previous parameter values as a priori information, less data are required to estimate the current parameters. Also, in addition to the savings obtained from reduced arithmetic operations, it is shown that a priori least squares generates a smoother set of predictor coefficients than those generated when a priori methods are ignored. Dissert. Abstr.

**N73-33105** Illinois Univ., Urbana.
**AN INVESTIGATION OF DIRECTIONAL PROPAGATION EFFECTS IN HIGH-FREQUENCY RADIO SOURCE LOCATION Ph.D. Thesis**
Roy Ian Beckwith 1972 243 p
Avail: Univ. Microfilms Order No. 73-17113

The prediction of horizontal ray-path deviation effects in high-frequency ionospheric propagation arising from large-scale temporal and geographical variations in the ionospheric structure is investigated. A technique for the rapid calculation of these predicted path deviation effects is presented. This technique involves the use of the Institute for Telecommunications Sciences ionospheric prediction model in conjunction with a procedure for determining the ray path geometry in three dimensions; it may be applied to both single-hop and multiple-hop high-frequency propagation paths. The main features and limitations of this three-dimensional predictive propagation model are discussed and examples are presented illustrating the use of this model in high-frequency radio source location applications and the influences of effective ionospheric tilts on a typical mid-latitude path. The representation of the effective ionospheric tilt in terms of a magnitude-azimuth pair is shown to be particularly convenient. Illustrations of the direct dependence of the effective tilt azimuth upon solar control effects in the ionosphere and of the effective tilt magnitude upon the proximity of the signal frequency to the maximum usable frequency for the appropriate path are provided. Dissert. Abstr.

**N73-33106** Texas Univ., Austin.
**AN ADAPTIVE SPEECH SYNTHESIZER Ph.D. Thesis**
Napoleon George Avaneas 1972 72 p
Avail: Univ. Microfilms Order No. 73-18396

An adaptive speech synthesizer is discussed, the word adaptive indicating that no one vocabulary, set of words, or natural language

is preferred over another for speech synthesis. The speech synthesizer is designed to exhibit the following properties: (1) intelligibility and naturalness of Synthesized Speech, (2) independence of natural language or vocabulary (Adaptiveness), (3) capability of continuous speech, and (4) small memory requirements and simplicity of operation. The process is realized in two steps. The first is a preparatory step and performs speech analysis by a software package. It is used to analyze and (dramatically) reduce the speech data of the words of the selected vocabulary, by a factor greater than 30:1, forming a pattern of a few hundred bits for each one of the selected words. The second step of the process is that realized by the speech synthesizer, a software package (for a hardware unit). When the speech synthesizer receives a binary word (a digital-coded signal, if it is a hardware realization), of n-bits, where 2 to the n power is larger than the number of words of the vocabulary, it synthesizes the word corresponding to the binary word (digital-coded signal) received. Dissert. Abstr.

**N73-33107*#** Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.

**A SCATTERING MODEL FOR RAIN DEPOLARIZATION**

Paris H. Wiley, Warren L. Stutzman, and C. W. Bostian [1973] 28 p refs

(Grant NGR-47-004-091)

(NASA-CR-132818) Avail: NTIS HC $3.50 CSCL 20N

A method is presented for calculating the amount of depolarization caused by precipitation for a propagation path. In the model the effects of each scatterer and their interactions are accounted for by using a series of simplifying steps. It is necessary only to know the forward scattering properties of a single scatterer. For the case of rain the results of this model for attenuation, differential phase shift, and cross polarization agree very well with the results of the only other model available, that of differential attenuation and differential phase shift. Calculations presented here show that horizontal polarization is more sensitive to depolarization than is vertical polarization for small rain drop canting angle changes. This effect increases with increasing path length. Author

**N73-33108#** Australian Post Office Research Labs., Melbourne.

**A SET OF SATELLITE LINK CALCULATION PROGRAMS**

M. Balderston and V. Laats May 1973 21 p

(Rept-6806) Avail: NTIS HC $3.25

Seven computer programs for analyzing satellite communication links have been written. The programs will run on any computer which provides a BASIC compiler. The equations used, sample runs, flow charts and complete listings are shown. The calculations provide for analysis of the RF links, antenna parameters, receiver parameters, and FM and PCM RF-to-baseband systems. Author

**N73-33109*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**RFI EMITTER LOCATION TECHNIQUES**

B. L. J. Rao Sep. 1973 13 p refs

(NASA-TM-X-70483; X-750-73-271) Avail: NTIS HC $3.00 CSCL 17B

The possibility is discussed of using Doppler techniques for determining the location of ground based emitters causing radio frequency interference with low orbiting satellites. An error analysis indicates that it is possible to find the emitter location within an error range of 2 n.mi. The parameters which determine the required satellite receiver characteristic are discussed briefly along with the non-real time signal processing which may by used in obtaining the Doppler curve. Finally, the required characteristics of the satellite antenna are analyzed. Author

**N73-33110#** Lockheed Missiles and Space Co., Palo Alto, Calif.

**RADIO SIGNALS, INTERFERENCE, AND APPARATUS IN CONTROL SYSTEMS**

S. A. Volkovskii, E. I. Onoprienko, and V. A. Savinov [1973] 42 p refs Transl. into ENGLISH of the book "Radioustroisva Sistem Upr. Letatel'nymi App." - Moscow, Mashinostroenie, 1972 p 48-98

Avail: NTIS HC $4.25; National Translations Center, John Crerar Library, Chicago, Illinois 60616

**The effect of interference on radio link operation is diminished** by a rational choice of the link parameters and the kind of signal used therein. Considered are the characteristics of interference, their interactions, and equivalent representation of interference in the control loop for optimal transmission of representative message parameters. It is noted that signals with triple modulation of the form PWM-FMn-AM, PCM-FMn-AM, PCM-FMn-FM, PCM-PMn-PM (RPM) are best for radio links where high interference immunity is required. G.G.

**N73-33111#** Lockheed Missiles and Space Co., Palo Alto, Calif.

**DETERMINATION OF THE DIFFERENCE IN GROUP PATHS BY THE METHOD OF FREQUENCY-DIVERSITY RECEPTION**

V. A. Rybin [1973] 5 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 13, no. 4, 1973 p 749-752

Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

A frequency-diversity reception method with a small base, being mutually and complementary, permits the investigation of moving ionospheric disturbances under different conditions. This method is used in the presence of short period polarization fading (several seconds), and the interference method in the absence of fading under rapid frequency scanning (1 MHz/sec). Samples of records of frequency-diversity polarization beats for a signal reflected from the F2 region are presented. It is seen how the magnitude and direction of the time shift varies during intersection of ordinary and extraordinary wave tracks. Author

**N73-33112#** AEG-Telefunken, Backnang (West Germany).

**SATELLITES FOR DIRECT TELEVISION TRANSMISSION [SATELLITEN FUER DIREKTE FERNSEHUEBERTRAGUNG]**

D. Koehn 1973 13 p In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17, May 1973

(DGLR-Paper-73-040) Avail: NTIS HC $3.00

The possibilities of using communication satellites for direct TV broadcasting are surveyed. The following possible satellite configurations are anslyzed: three-axis stabilized with rigid sun-pointed solar generator and rotating antenna, three-axis stabilized with rigid earth-pointed antenna and rotating solar generator, and triple spin satellite with rotating antenna and solar generator. ESRO

**N73-33113#** Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).

**MISSION, PROJECT DEVELOPMENT, AND DESCRIPTION OF THE SYMPHONIE SATELLITE [MISSION, PROJEKTABLAUF UND BESCHREIBUNG DES SATELLITEN SYMPHONIE]**

F. W. Kraemer 11 May 1973 20 p In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17, May 1973

(DGLR-Paper-73-043) Avail: NTIS HC $3.00

Details of the mission, project development and configuration of the Symphonie communication satellite are presented. The project feasibility was established and the design frozen. Model tests were successfully terminated, and the prototype integration is being carried out. Compatibility tests were made. Limitations of the launch windows, and shadow times are discussed. ESRO

**N73-33114#** AEG-Telefunken, Backnang (West Germany).

**COMMUNICATION SYSTEMS OF GROUND STATIONS FOR A TELEVISION BROADCASTING SATELLITE [NACHRICHTENTECHNISCHE BODENSYSTEME FUER EINEN FERNSEHRUNDFUNKSATELLITEN]**

Fred Solzbacher 1973 17 p In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17 May 1973

(DGLR-Paper-73-055) Avail: NTIS HC $3.00

The planning of a communication system for a central ground station for a direct TV broadcasting satellite is detailed, and the special requirements for satellite transmission in the 12/14 GHz range discussed. The signals coming from the satellite are received by individual receivers and demodulated, and the signal forms for different distribution systems are generated. A comparison is made between direct processing of the TV baseband and audio

signal, and remodulation and conversion to the UHF-VHF range. Three different types of home receivers were considered, and the planning of these receivers discussed. ESRO

**N73-33115#** Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
**THE TELECOMMUNICATION SYSTEM AND SPECIFIC TRANSMISSION PARAMETERS OF THE SYMPHONIE SATELLITE [DAS FERNMELDETECHNISCHE SYSTEM DER SYMPHONIE-SATELLITEN UND SPEZIELLE UEBERTRAGUNGSPARAMETER]**
M. Meunier (Centre Natl. d'Etudes de Telecomun., Paris) and G. Oppenhaeuser 1973 13 p In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17 May 1973 (DGLR-Paper-73-056) Avail: NTIS HC $3.00

The transponder system parameters of the Symphonie satellite are discussed. The system is based on the following principles: reception of 6 GHz signals by means of a horn antenna with global coverage areas, distribution of signals to several channels by means of dividers, low noise preamplification, double frequency conversion, power amplification, and transmission of signals in the 4 GHz range via paraboloid antennas in define coverage areas. As a particular problem, the suppression of intelligible crosstalk is dealt with. Results of the integrated transponder are reported. ESRO

**N73-33116#** AEG-Telefunken, Backnang (West Germany). Fachgebiet Raumfahrt.
**TRANSPONDERS FOR EUROPEAN COMMUNICATION SATELLITE SYSTEMS (ECS AND OTS PROGRAMS) [TRANSPONDER FUER EUROPAEISCHE NACHRICHTEN-SATELLITENSYSTEME (ECS UND OTS PROGRAMM)]**
E. Mondre and H. K. Ball 1973 20 p In GERMAN Presented at the DGLR Symp. Nachrichten-Satelliten, Stuttgart, 16-17 May 1973
(DGLR-Paper-73-057) Avail: NTIS HC $3.00

Details of the European Communication Satellite (ECS) and Orbital Test Satellite (OTS) transponders are presented. The ECS modular repeater, the design of the transponder, and test results are discussed. The OTS was planned as a test for new technologies and equipment for the ECS. Its payload consists of a transmission transponder and a beacon transponder, both of which are described. ESRO

**N73-33117#** Lincoln Lab., Mass. Inst. of Tech., Lexington.
**AN INTRODUCTION TO THE MATHEMATICS OF LINEAR PREDICTIVE FILTERING AS APPLIED TO SPEECH ANALYSIS AND SYNTHESIS**
Edward M. Hofstetter 12 Jul. 1973 29 p refs
(Contract F19628-73-C-0002; ARPA Order 2006)
(AD-765176; TN-1973-36; ESD-TR-73-186) Avail: NTIS CSCL 17/2

The note presents a tutorial survey of the mathematics that is used in the study of linear predictive filtering as applied to the analysis and synthesis of speech. Speech is modelled as the output of an all-pole filter that is driven by either a periodic pulse train or white noise. A minimum-mean-squared-error technique for estimating the coefficients of this filter from speech data is presented. This technique leads to a set of equations for the coefficient estimates which can be solved by a computationally efficient recursive technique known as Levinson's method. The filter derived by the above mentioned technique can be realized by any standard technique; however, a particularly interesting realization is in terms of a digital simulation of a non-uniform acoustic tube. It is shown that any stable all-pole filter can be realized as an acoustic tube and, moreover, that the Levinson recursion produces as a by-product exactly the reflection coefficients needed for such a realization. The report concludes by showing how the classical theory of orthogonal polynomials can be applied to the speech analysis/synthesis problem and used to derive many of the results obtained above by other means. Author (GRA)

**N73-33118#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**COMPARATIVE EFFICIENCY OF MONOPULSE RADAR DIRECTION-FINDING SYSTEMS**
E. F. Sviridov 6 Aug. 1973 161 p refs Transl. into ENGLISH from the monograph "Sravnitelnaya Effektivnost Monoimpulsnykh Radiolakatsionnykh Sistem Pelengatsii" USSR, 1964 p 1-116 (AD-765545; FTD-MT-24-301-73) Avail: NTIS CSCL 17/9

From the positions of unified theory the circuits of monopulse systems are examined and the rules of the processing of signals in them are formulated. In accordance with the rules of processing, block diagrams of monopulse systems are synthesized. Requirements are examined which must be satisfied by the basic elements of circuits of monopulse direction finders with the various forms of sounding signals. The analysis of the maximum accuracy of monopulse direction finding is carried out both for a determinate signal and for a signal with random parameters, at an arbitrary target position in the direction finding zone. Block diagrams of optimum resolvers with phase and amplitude monopulse direction finding and the distribution laws of optimum estimates of angular position are determined. GRA

**N73-33841*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**TELEVISION EXPERIMENT**
G. A. Briggs, J. A. Cutts, R. H. Steinbacher, T. E. Thorpe, A. B. Whitehead, G. DeVaucouleurs (Tex. Univ., Austin), M. E. Davies (Rand Corp., Santa Monica, Calif.), H. Masursky (Geological Survey, Flagstaff, Ariz.), and J. B. Pollack (NASA. Ames Res. Center) *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 63-70 refs Prepared in cooperation with NASA. Ames Res. Center (For availability see N73-33834 24-31)
CSCL 09F

# 08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

**N73-33119** California Univ., Irvine.
**COMPUTER AIDED DESIGN OF OPTIMAL CONTROL SYSTEMS Ph.D. Thesis**
Carl Owen Jelinek 1973 195 p
Avail: Univ. Microfilms Order No. 73-19009

An investigation is documented of the use of mathematical programming methods for the solution of the pole placement problem in optimal control system synthesis. More specifically, the work presents two algorithms (generalized polynomial programming and adaptive random search) for the solution of constrained non-linear optimization problems. A technique is presented for both formulating and solving multi-input/multi-output linear time-invariant optimal control synthesis problems with stationary noise inputs, without solving an algebraic matrix Riccati equation. This method, formulated in the time domain, allows for constraints on system parameters and performance in both the frequency and time domains. Since it does not depend on spectral factorization, it is much easier to extend to the multi-input/multi-output case. To illustrate the application of the theory developed in this dissertation, several problems from both classical and modern control theory are formulated and solved. The theory of the mathematical programming algorithms is presented in the appendices along with a supplementary software package for generalized polynomial algebraic manipulations. Dissert. Abstr.

**N73-33120** Illinois Univ., Urbana.
**SYSTEM SOFTWARE FOR A FAULT-TOLERANT DIGITAL COMPUTER Ph.D. Thesis**
John Allen Rohr 1973 347 p
Avail: Univ. Microfilms Order No. 73-17632

The software is designed for the STAR (self-testing-and-repairing) computer designed and constructed at the Jet Propulsion Laboratory. The system software consists of a programming system and a resident executive. An introduction to fault-tolerant computing and the STAR computer is given. Then the programming system is described. Unique features of the programming system which are required by the fault-tolerant features of the STAR computer are emphasized. The principal effort of the investigation is the design of a resident executive for the STAR computer. STAR computer programs require special considerations

for proper operation in the fault-tolerant hardware environment. A general description of the resident executive is presented, including details of the rollback mechanism, followed by a detailed description of the functions, problems, and solutions for each category of routines. Finally, the results of the investigation are presented in condensed form. The most significant results are the design of the self-repair software, the invention of rollback schemes for both system and user programs, and the solution of subroutine library usage conflicts. Dissert. Abstr.

**N73-33121** Illinois Univ., Urbana.
**OBSERVER POSITION DETECTOR FOR THE STEREOMATRIX 3-D DISPLAY SYSTEM Ph.D. Thesis**
Charles Raymond Pirnat 1972 65 p
Avail: Univ. Microfilms Order No. 73-17361

STEREOMATRIX is a display system which presents computer generated three dimensional line figures. This rear-projection laser display has two interesting features. A lighted spot called the cursor can be moved around in the viewing space by the observer with a joystick. This feature allows the observer to select a point in the viewing space and relate it to the computer space. It is also possible for the observer to draw in the viewing space. The position detection system is basically an infrared optical scanning system with shaft encoders which yield digital sine and cosine values of shaft angle. Dissert. Abstr.

**N73-33122*#** System Development Corp., Huntsville, Ala.
**ANALYSIS OF REQUIREMENTS FOR COMPUTER CONTROL AND DATA PROCESSING EXPERIMENT SUBSYSTEMS, IMAGE DATA PROCESSING SYSTEM (IDAPS) USERS MANUAL (7094 VERSION), VOLUME 1**
15 Sep. 197? 110 p 2 Vol.
(Contract NAS8-25471)
(NASA-CR-124438; TM(L)-HU-033/008/0C-Vol-1) Avail: NTIS CSCL 09B

A user's manual is presented for IDAPS (Image Data Processing System) a computer based, user oriented language and control system for use in processing image data. It was designed to meet the requirements for restoring, enhancing, and analyzing X-ray photographic images returned by the Solar Imaging X-ray Telescope. Although IDAPS was developed for this telescope, the capabilities of the system are general purpose in nature and are applicable to many other image processing applications. Image processing techniques incorporated in IDAPS include capabilities for filtering, convolving, deconvolving, correlating, contouring, smoothing, gray scale altering, averaging, rotating, expanding, scaling, and subsetting. A total of 44 operators are available to the user for use in restoring, enhancing, or analyzing images. In addition, 22 operators are provided to assist the user in controlling the image processing sequence including image input and output file handling, and looping. Author

**N73-33123*#** System Development Corp., Huntsville, Ala.
**ANALYSES OF REQUIREMENTS FOR COMPUTER CONTROL AND DATA PROCESSING EXPERIMENT SUBSYSTEMS: IMAGE DATA PROCESSING SYSTEM (IDAPS) SOFTWARE DESCRIPTION (7094 VERSION), VOLUME 2**
15 Sep. 1973 134 p 2 Vol.
(Contract NAS8-25471)
(NASA-CR-124447; TM(L)-HU-033/008/00-Vol-2) Avail: NTIS HC $8.75 CSCL 09B

A description of each of the software modules of the Image Data Processing System (IDAPS) is presented. The changes in the software modules are the result of additions to the application software of the system and an upgrade of the IBM 7094 Mod(1) computer to a 1301 disk storage configuration. Necessary information about IDAPS sofware is supplied to the computer programmer who desires to make changes in the software system or who desires to use portions of the software outside of the IDAPS system. Each software module is documented with: module name, purpose, usage, common block(s) description, method (algorithm of subroutine) flow diagram (if needed), subroutines called, and storage requirements. Author

**N73-33124*#** Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
**ROBOT, COMPUTER PROBLEM SOLVING SYSTEM Final Progress Report**
Joseph D. Becker and E. William Merriam Sep. 1973 71 p refs
(Contract NASw-2236)
(NASA-CR-135899; BBN-2646) Avail: NTIS HC $5.75 CSCL 09B

The TENEX computer system, the ARPA network, and computer language design technology was applied to support the complex system programs. By combining the pragmatic and theoretical aspects of robot development, an approach is created which is grounded in realism, but which also has at its disposal the power that comes from looking at complex problems from an abstract analytical point of view. Author

**N73-33125#** Defence Scientific Information Service, Ottawa (Ontario).
**THE DSIS REPORT SEARCH CODE STUDY**
Brian E. OReilly Apr. 1973 42 p refs
(DSIS-TN-11) Avail: NTIS HC $4.25

Duplication of coverage between material in the internally generated Defense Scientific Information Service data base and bibliographic data has resulted in the development of a report search code that can be automatically generated by a computer from bibliographic data available in machine readable form. A sucess rate of 85 to 90% in identifying duplicate material using this code for data matching purposes was achieved. Author

**N73-33126#** Defence Scientific Information Service, Ottawa (Ontario).
**A HYBRID INTERACTIVE SEARCH SYSTEM**
John D. Currie (Digital Methods Ltd.) Aug. 1973 11 p refs
Presented at the 1st Open Conf. in Inform. Sci. in Canada, Montebello, Quebec, 14-15 May 1973
(DSIS-TN-13) Avail: NTIS HC $3.00

Independent storage and retrieval systems based on either micrographic or computer techniques have been extensively used. A different approach is to assemble a flexible hybrid system in which bulk storage is in microform, while dictionaries used in searching are stored in a computerized data bank. The economics, response time and search methods of the Defense Scientific Information Service (DSIS) retrospective search system are examined. Author

**N73-33127#** Aeronautical Research Labs., Melbourne (Australia).
**DEC SYSTEM 10 SIMULATION Progress Report**
R. C. Adams Apr. 1973 52 p
(ARL/SM-392; PR-1) Avail: NTIS HC $4.75

A study was made to evaluate and optimize the performance of the System 10 computer. Various evaluation methods were analyzed and it was concluded that simulation offers advantages over the others. Of the possible simulation schemes it is shown that the most satisfactory method is to simulate the hardware directly. The methodology is described and the preliminary results obtained are presented. In addition, the System 10 hardware, the monitor functions, and the action and simulation of peripheral devices are described. Author

**N73-33128*#** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
**GROUND OPERATIONS AEROSPACE LANGUAGE (GOAL)**
6 Nov. 1973 15 p refs
(NASA-TM-X-69541) Avail: NTIS HC $3.00 CSCL 09B

GOAL, is a test engineer oriented language designed to be used to standardize procedure terminology and as the test programming language to be used for ground checkout operations in a space vehicle launch environment. The material presented concerning GOAL includes: (1) a historical review, (2) development objectives and requirements, (3) language scope and format, and (4) language capabilities. D.L.G.

**N73-33129*#** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
**GROUND OPERATIONS AEROSPACE LANGUAGE (GOAL) TEXTBOOK**
Larry R. Dickison 16 Apr. 1973 275 p
(NASA-TM-X-69542; KSC-TR-1228) Avail: NTIS HC $15.75 CSCL 09B

The textbook provides a semantical explanation accompanying

a complete set of GOAL syntax diagrams, system concepts, language component interaction, and general language concepts necessary for efficient language implementation/execution.
Author

**N73-33130*#** Hughes Aircraft Co., Fullerton, Calif.
**DESIGN OF A MODULAR DIGITAL COMPUTER SYSTEM Phase 2 Report, 16 Mar. 1972 - 1 Mar. 1973**
1 Mar. 1973 308 p
(Contract NAS8-27926)
(NASA-CR-124171; FR-73-11-168) Avail: NTIS HC $17.50 CSCL 09B

A design tradeoff study is reported for a modular spaceborne computer system that is responsive to many mission types and phases. The computer uses redundancy to maximize reliability, and multiprocessing to maximize processing capacity. Fault detection and recovery features provide optimal reliability. G.G.

**N73-33131#** Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
**SPEECH AND PICTURE PROCESSING Semiannual Technical Report, 15 Jan. - 15 Jul. 1973**
Alan V. Oppenheim 2 Aug. 1973 36 p refs
(Contract N00014-67-A-0204-0064; ARPA Order 1997)
(AD-764968) Avail: NTIS CSCL 09/4

During the first half of the contract year, the program continued the following studies: speech analysis by linear prediction, digital frequency warping, development of a high speed digital processor for speech synthesis, and the design of two-dimensional recursive digital filters. These projects are summarized and reprints of available publications are appended.
Author (GRA)

**N73-33132#** Maryland Univ., College Park. Computer Science Center.
**A TECHNIQUE FOR FACILITATING THRESHOLD SELECTION FOR OBJECT EXTRACTION FROM DIGITAL PICTURES**
J. S. Weszka, R. N. Nagel, and A. Rosenfeld May 1973 55 p refs
(Contract F44620-72-C-0062; AF Proj. 9769)
(AD-764736; AFOSR-73-1263TR) Avail: NTIS CSCL 09/2

Threshold selection for picture segmentation is relatively easy when the frequency distribution of gray levels in the picture is strongly bimodal, with the two peaks comparable in size and separated by a deep valley. The report describes a method of handling cases in which the peaks are very unequal in size and the valley is broad. A Laplacian operation is applied to the picture to determine points that lie on or near the edges of objects. Threshold selection becomes easier when the frequency distribution of gray levels of these points is used. Author (GRA)

**N73-33537** Joint Publications Research Service, Arlington, Va.
**AUTOMATION OF THE PROCESSES OF GATHERING AND PRIMARY PROCESSING OF SCIENTIFIC INFORMATION ON THE EXPEDITIONS OF THE ARCTIC AND ANTARCTIC SCIENTIFIC RESEARCH INSTITUTE**
I. A. Dyubkin *In its* Meteorol. and Hydrol., No. 7, 1973 (JPRS-60164) 28 Sep. 1973 p 73-85 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 97-103 (For availability see N73-33530 24-20)

## 09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

**N73-33133** California Univ., Davis.
**NEW CONTRIBUTIONS TO THE ANALYSIS AND DESIGN OF ACTIVE RC FILTERS Ph.D. Thesis**
Michael Alan Soderstrand 1972 150 p
Avail: Univ. Microfilms Order No. 73-19110

The realization of second-order RC-Amplifier type active filters is considered. The basic limitations of such filters with respect to gain and sensitivity, the development of low sensitivity filters, and the design of filters without external capacitors are studied. Also reported is a sensitivity analysis of higher order filters. Active filters using at most two voltage amplifiers are classified into ten possible groups based upon the nature of the generation of the complex poles. The gain and sensitivity limitations for each of these classes are derived. With the aid of these results it is possible to evaluate the gain and sensitivity properties of a specific filter configuration simply by determining the class to which it belongs. Dissert. Abstr.

**N73-33134** Illinois Univ., Urbana.
**FAST HEURISTIC TECHNIQUES FOR PLACING AND WIRING PRINTED CIRCUIT BOARDS Ph.D. Thesis**
James Edward Stevens, Jr. 1972 126 p
Avail: Univ. Microfilms Order No. 73-17438

A comparison of existing placement techniques is presented. Large realistic printed circuit board problems are introduced and used to make comparisons. The value of different placements is measured by the total wire length generated as well as by the results of actually routing the connections on the board. A new wire routing algorithm called Channel Routing, is proposed. The Channel Routing algorithm is faster than existing routing techniques and can handle very large circuit board problems. The results of implementing the basic Channel Routing algorithms are presented. These results are also used to compare the effectiveness of the different placement algorithms.
Dissert. Abstr.

**N73-33135** Clemson Univ., S.C.
**FLUXION COUPLING IN SUPERCONDUCTING dc TRANSFORMERS Ph.D. Thesis**
William Alfred Lindstrom 1972 56 p
Avail: Univ. Microfilms Order No. 73-19272

The coupling parameter was measured for superconducting dc transformers as a function of the separation of the two films and of the thickness of the primary film. In all experiments both the primary and secondary films were of tin, and the secondary film thickness was fixed at 200 nm. The tin films were separated by a layer of silicon monoxide. With the primary film thickness fixed at 400 nm, (V sub S/V sub P) sub zero decreased from one to zero as the separation increased from 500 to 1200 nm. With the separation fixed at 30 nm, (V sub S/V sub P) sub zero decreased from one to zero as the primary film thickness decreased from 75 nm to 45 nm. Dissert. Abstr.

**N73-33136#** National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
**CONSIDERATIONS FOR THE PRECISE MEASUREMENT OF AMPLIFIER NOISE**
David F. Wait Aug. 1973 133 p refs
(NBS-TN-640) Avail: SOD HC $1.25 as C13.46:640

For the best accuracy in measuring noise figure, attention needs to be given to the choice of the hot and the cold noise standards and to mismatch problems. Tables and graphs are presented to aid in choosing the measurement conditions, and an example is given to demonstrate their use. Author

**N73-33137#** California Univ., Livermore. Lawrence Livermore Lab.
**STREAK CAMERA TUBE DEVELOPMENT**
R. Kalibjian and C. McConaghy 2 Mar. 1973 6 p ref Sponsored by AEC
(UCID-16218) Avail: NTIS HC $3.00

A high speed cathode ray tube was modified for streak camera application by replacing the thermionic cathode with an S-1 photocathode. This is the first step in the development of a 2-picosecond resolution streak camera tube. Development of an X-ray photocathode for the streak camera tube is also reported.
Author (NSA)

**N73-33138#** California Univ., Livermore. Lawrence Livermore Lab.
**TIME-RESOLVED VOLTAGE BREAKDOWN IN VARIOUS INSULATORS DUE TO 2-MeV ELECTRONICS**
L. M. Erickson and D. C. Oakley 5 Apr. 1973 22 p
(Contract W-7405-eng-48)

(UCRL-51372) Avail: NTIS HC $4.00

**A pulsed beam of electrons from a 2-MeV Febetron was** injected into several insulating materials and the resultant self-breakdown characteristics of the materials were studied. The materials included lucite, vinyl chloride, polyethylene, Teflon, pyrex, type 815 epoxy, and pyrex glass. The threshold for formation of Lichtenberg figures was established for several of the materials. High-speed photography was used to observe the figures as they formed in some of the transparent materials, and propagation velocities were established for some exposure levels. Propagation velocities were found to vary as a function of exposure level for those materials and exposure levels in which measurement were obtained. Author (NSA)

**N73-33139#** Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.

**PHOTOENGRAVING: PRINCIPLE AND UTILIZATION OF PHOTORESIST IN PLANAR TECHNIQUES [LA PHOTOGRAVURE. PRINCIPLE ET UTILISATION DU PHOTORESIST EN TECHNIQUE PLANAR]**

G. Pierrel and J. Chevalier Mar. 1973 53 p refs In FRENCH (LAAS-FI-73-T-11) Avail: NTIS HC $4.75

The principles of metal oxide semiconductor photoengraving with positive and negative resins are described. Physical and chemical properties of AZ 1350 Shipley positive resin and K PR, KTFR, KMER Kodak negative resins are detailed. Adhesivity, resolving power, light sensitivity, and chemical resistance for these resins are detailed and compared. Resins technology is discussed and procedures are detailed with regard to film thickness, film uniformity, pinholes, and resin viscosity. Masking operations, dust contamination, furnaces and loads are discussed. Chemical cleaning procedures and reagents are specified as well as procedures for positive resin utilization including metals chemical attack. Procedures for negative resin utilization are also specified. Present technology limitations and future prospects are discussed. ESRO

**N73-33140#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Satellitenelektronik.

**THE SIGNIFICANCE OF STRENGTH FOR THE RELIABILITY OF SOLDER JOINTS IN ELECTRONICS**

Rudolf Gohle 9 Feb. 1973 70 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-33) Avail: NTIS HC $5.50; DFVLR, Porz, West Ger. 25,20 DM

The strength of soldered joints in printed circuits was analyzed. The fundamental requirement of a soldered joint is a constant electrical resistance, and all the factors effecting this prerequisite are summarized. Possible loads on the joints, such as short term loads, creep stresses, and cyclic loads, are mentioned. Possible influences on the elastic and plastic behavior of the material are outlined. It was found that the failure of these joints is caused mainly by incidential and periodic temperature variations for different thermal expansion coefficients of the materials utilized. ESRO

**N73-33141#** Army Foreign Science and Technology Center, Charlottesville, Va.

**MAGNETIC ANTENNAS**

M. V. Vershkov 24 Nov. 1972 48 p Transl. into ENGLISH from the book 'Sudovye Antenny" USSR, 1972 p 247-283 (AD-765364; FSTC-HT-23-357-73) Avail: NTIS CSCL 09/5

Performance data and other characteristics of magnetic antennas are discussed. Author (GRA)

**N73-33142#** Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.

**STATISTICAL DESIGN OF NONRECURSIVE DIGITAL FILTERS**

David C. Farden and Louis L. Scharf 31 Jul. 1973 42 p refs Revised

(Contracts N00123-73-C-1375; N00014-67-A-0299-0019) (AD-764595) Avail: NTIS CSCL 09/5

The problem of designing a finite duration impulse response (FIR) digital filter to approximate a desired spectral response is treated in the paper. The philosophy adopted is that for a given FIR filter structure, the filter coefficients can be designed to provide a minimum mean-squared error (MMSE) estimate of a random signal sequence (the design signal) imbedded in a random noise sequence. By treating the signal and noise covariance functions as design parameters, one can design FIR filters with spectral responses that approximate the power spectral density of the design signal. For signal processing applications that require some attention to signal fidelity, as well as noise rejection, the MMSE philosophy seems appropriate (as opposed to a maximum signal-to-noise ratio philosophy, for example). (Modified author abstract) GRA

**N73-33143#** Aerospace Corp., El Segundo, Calif. Lab. Operations.

**ADVANTAGES OF MOTT BARRIER MIXER DIODES Report for May 1971 - May 1972**

Malcolm McColl and Michael F. Millea 26 Jul. 1973 16 p refs

(Contract F04701-73-C-0074)

(AD-765182; TR-0074(4230-50)-2; SAMSO-TR-73-238) Avail: NTIS CSCL 09/1

It is shown that the high frequency performance of mixer diodes can be appreciably improved by employing a Mott barrier instead of a Schottky barrier. The larger junction diameters possible with Mott structures also allow a better burnout capability and improved mechanical stability. Author (GRA)

**N73-33144#** Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.

**RELIABILITY STUDY CIRCULAR ELECTRICAL CONNECTORS Final Technical Report, Jan. 1972 - Jan. 1973**

Kathleen M. Plein, James R. Funk, and Lawrence E. James Jun. 1973 183 p refs

(Contract F30602-72-C-0166)

(AD-765609; FR-73-16-344; RADC-TR-73-171) Avail: NTIS CSCL 09/1

The major objectives of the study were to recommend guidelines for selection and application of circular electrical connectors and improved test methods. The study was restricted to connectors covered by specifications MIL-C-5015, 26500, 27599, 38999, 81511, and 83723. Conclusions reached are summarized as selection guidelines, improved test methods, and recommendations. Most highly recommended are design features which tend to prevent or reduce human abuse, and standardization of connector design and testing, so that cost, inventories, and difficulties in selection can be reduced and so that different connectors are more easily compared with one another. The preferred connector of the six is MIL-C-38999, based on the data available. (Modified author abstract) GRA

**N73-33634** Tetra Tech, Inc., Pasadena, Calif.

**RECEIVERS: PHOTOELECTRIC AND PHOTOGRAPHIC DETECTORS**

Henri Hodara and Willard H. Wells *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 15 p (For availability see N73-33619 24-23)

# 10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

**N73-33145** Southern Methodist Univ., Dallas, Tex.

**ON THE DESIGN AND APPLICATION OF WAVE DIGITAL FILTERS Ph.D. Thesis**

Karl Hertzian Renner 1973 204 p

Avail: Univ. Microfilms Order No. 73-18216

The wave digital filter patterned after doubly terminated ladder networks by means of the Richard's transformation has been conjectured to have low coefficient sensitivity properties. Such properties permit implementation of a digital structure with lower computer wordlengths than with conventional structures. The exact nature of the relationship between the wave digital filter structure and these networks is examined. The sensitivity properties of the ladder structure are incorporated into the wave

filter by the transformation. Formulation of a design algorithm makes the somewhat complex task easier. Dissert. Abstr.

**N73-33146** Idaho Univ., Moscow.
**THE DESIGN OF SEQUENTIAL CIRCUITS USING EDGE AND LEVEL SENSITIVE FLIP-FLOPS Ph.D. Thesis**
Donald Karel Fronek 1973 89 p
Avail: Univ. Microfilms Order No. 73-18278

Procedures for designing sequential circuits with level sensitive flip-flops have been firmly established and are well known. Recently, a technique was proposed for designing with edge sensitive flip-flops. This thesis extends the proposed technique and establishes analysis and synthesis procedures for sequential circuits that are realized with flip-flops that are both edge-and-level sensitive. Every major manufacturer of integrated circuits currently produces flip-flops with edge-and-level triggering which are commonly used by practical logic designers. An in-depth analysis and synthesis procedure is established for the set-reset clocked-data (SRCD) flip-flop. However, many of the SRCD rules will apply to other edge-and-level flip-flops. This procedure allows a more efficient use of existing edge-and-level flip-flops and often minimizes the external gate logic. Dissert. Abstr.

**N73-33147#** Academy of Sciences (USSR), Moscow.
**PROBLEMS OF CYBERNETICS. UNIFORM MICROELECTRONIC STRUCTURES [VOPROSY KIBERNETIKI. ODNORODNYYE MIKROELEKTRONNYYE STRUKTURY]**
S. I. Samoylenko, ed. 1973 160 p refs In RUSSIAN
Avail: NTIS HC $10.00

Problems of numerical analysis are applied to homogeneous microelectronic structures including transistors and lasers. Associative parallel processors are discussed in relation to decision theory, control theory, and the minimization of Boolean functions. Optical tuning and interference impulse stability in logic inverters are also considered. Transl. by K.P.D.

**N73-33148*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**EVALUATION OF CONTROL LAWS AND ACTUATOR LOCATIONS FOR CONTROL SYSTEMS APPLICABLE TO DEFORMABLE ASTRONOMICAL TELESCOPE MIRRORS**
Aaron J. Ostroff Washington Oct. 1973 64 p refs
(NASA-TN-D-7276; L-8862) Avail: NTIS HC $3.50 CSCL 09C

Some of the major difficulties associated with large orbiting astronomical telescopes are the cost of manufacturing the primary mirror to precise tolerances and the maintaining of diffraction-limited tolerances while in orbit. One successfully demonstrated approach for minimizing these problem areas is the technique of actively deforming the primary mirror by applying discrete forces to the rear of the mirror. A modal control technique, as applied to active optics, has previously been developed and analyzed. The modal control technique represents the plant to be controlled in terms of its eigenvalues and eigenfunctions which are estimated via numerical approximation techniques. The report includes an extension of previous work using the modal control technique and also describes an optimal feedback controller. The equations for both control laws are developed in state-space differential form and include such considerations as stability, controllability, and observability. These equations are general and allow the incorporation of various mode-analyzer designs; two design approaches are presented. The report also includes a technique for placing actuator and sensor locations at points on the mirror based upon the flexibility matrix of the uncontrolled or unobserved modes of the structure. The locations selected by this technique are used in the computer runs which are described. The results are based upon three different initial error distributions, two mode-analyzer designs, and both the modal and optimal control laws. Author

**N73-33149#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**SYSTEMS WITH VARIABLE STRUCTURE**
G. I. Vaniurikhin, A. N. Gerasimov, S. V. Luchko, and L. F. Porfirev [1973] 4 p Transl. into ENGLISH of the book "Osnovy Avtomaticheskogo Upravleniia" Moscow, Voenizdat, 1972 p 294-298
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Automatic control system is considered in which the coupling between the functional elements changes as a function of the state of the system. The diagram of a servo system with variable damping constructed on the SVS principle is given. Its control unit can either break or restore the coupling between the tachogenerator output and the system amplifier input depending on the magnitude of the voltage in its winding. The servo system can therefore have two linear structures: with the tachogenerator disconnected or connected. Author

**N73-33150#** California Univ., Berkeley. Lawrence Berkeley Lab.
**USING HIGH SPEED DIGITAL INTEGRATED CIRCUITS FOR NUCLEAR INSTRUMENTATION**
R. F. Althaus, K. L. Lee, F. A. Kirsten, and L. J. Wagner May 1973 7 p refs Presented at Intern. Conf. on Instrumentation for High Energy Phys., Frascati, Italy, 8 May 1973
(Contract W-7405-eng-48)
(LBL-1750; Conf-730531-4) Avail: NTIS HC $3.00

The use and performance characteristics of high speed digital integrated circuits 91.C.'s as logical elements in high speed energy physics instruments are discussed. Two modular packaging schemes using MECL 3 I.C.'s were developed. The FLOGIC system, achieves high packaging density by means of logic cards that are interconnected in a custom design unique to each experiment. The FLOGIC system is most suitably used where many channels of instrumentation are required and the configuration of these channels, once established, is not subject to frequent unprescribed change. The second scheme uses the NIM standard hardware. This scheme offers the convenience and versatility of standardized hardware and signal levels. Author (NSA)

**N73-33151#** Rome Air Development Center, Griffiss AFB, N.Y.
**RELIABILITY EVALUATION OF 54L20 RADIATION HARDENED DUAL NAND GATES Final Report**
Jack S. Smith, Vincent C. Kapfer, and Edgar A. Doyle, Jr. Jun. 1973 52 p refs
(AD-765173; RADC-TR-73-180) Avail: NTIS CSCL 09/2

Radiation hardened low power microcircuits using high resistivity thin film chrome silicide resistors were evaluated by subjecting the devices to conventional high temperature stress tests and a special low temperature screen test. The predominant failure mechanisms of two failures generated under the high temperature stress tests consisted of oxide defects and surface inversion. Results of this test program indicated there were no thin film resistor failures in these devices either under high temperature or low temperature test conditions. It appears that the chrome silicide resistors show promise of improving the reliability of hardened circuits, however, other factors may be contributing to these observed results. Author (GRA)

# 11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

**N73-33152*#** Massachusetts Inst. of Tech., Cambridge.
**[RESEARCH ON HAYSTACK RADIOMETER, 20-24 GHz MASER, AND RADIO ASTRONOMY PROGRAMS] Semiannual Report of the Haystack Obs.**
15 Jul. 1973 52 p refs Prepared for Northeast Radio Obs. Corp.
(Grant NGR-22-174-003; Contract F23601-71-C-0092; Grant NSF GP-25865)
(NASA-CR-135773) Avail: NTIS HC $4.75 CSCL 14B

During the first half of 1973, the Haystack antenna was utilized 76% of the time. Of this useful time, 72% was devoted to radio astronomy observing, 5% was spent on radar-related research and 23% went into maintenance and system improvements. Twenty-eight new radio astronomy programs were

accepted, eight of which were completed during the period. One new radar program, topographic observations of Mars, was started in June and will be completed early in 1974. Fourteen programs continued from the previous period were also defined as complete. As of 1 July, 28 ratio observing programs were in a continuing status on the Haystack books. Four radar projects were also continuing. The 20-24 GHz maser development described in the preceding report progressed very well during an on-antenna test phase which began early in the year, but which terminated unfortunately in June with the complete loss of gain in the maser. Investigation of this problem is in progress. During this on-antenna test phase, the most sensitive water vapor observing capability which has yet become available was demonstrated. Author

**N73-33153*#** Research, Inc., Minneapolis, Minn. Controls Div.
**AERODYNAMIC THERMAL SIMULATION SYSTEM. PART 1: RADIANT ARRAY (INSTRUCTION MANUAL) Final Report**
A. F. Kitchar and R. L. Steuffen [1973] 103 p Original contains color illustration
(Contract NAS8-26416)
(NASA-CR-124435) Avail: NTIS HC $7.25 CSCL 14B

An aerodynamic thermal simulation system (ATSS) is presented. The construction of the system, the maintenance, set up, and operations are reported. System description of the radiant array is given along with the array subsystems modular heating unit, adjustable stanchion frame, cooling water system, and the gaseous nitrogen cooling system. The array configuration procedure outlines the set up and the start up. Maintenance procedures involve both lamp maintenance and reflector maintenance along with weather protection. Drawing codes are included. Descriptions of the 36 zone ATSS controls are also given. Each zone is an independent closed loop temperature control circuit. Procedures are presented for starting and stopping the system. The DATA-TRAK programmer and its operation, instruction manuals for the temperature controller and the power regulator and discriptions of peripheral equipment are discussed. T.M.R.

**N73-33154*#** Research, Inc., Minneapolis, Minn. Controls Div.
**AERODYNAMIC THERMAL SIMULATION SYSTEM. PART 2: SYSTEM CONTROLS (INSTRUCTION MANUAL) Final Report**
A. F. Kitchar and R. L. Steuffen [1973] 59 p refs
(Contract NAS8-26416)
(NASA-CR-124436) Avail: NTIS HC $5.00 CSCL 14B
For abstract, see N73-33153.

**N73-33155*#** Research, Inc., Minneapolis, Minn. Controls Div.
**AERODYNAMIC THERMAL SIMULATION SYSTEM. PART 3: RELATED REFERENCE MATERIAL (INSTRUCTION MANUAL) Final Report**
A. F. Kitchar and R. L. Steuffen [1973] 274 p
(Contract NAS8-26416)
(NASA-CR-124437) Avail: NTIS HC $15.75 CSCL 14B
For abstract, see N73-33153.

**N73-33156*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**MINITRACK TRACKING FUNCTION DESCRIPTION, VOLUME 2 Final Report**
Thomas S. Englar, Stephen A. Mango, Charles A. Roettcher, and David L. Watters Mar. 1973 315 p refs Prepared by Control Systems Res., Inc.
(Contract NAS5-10694)
(NASA-TM-X-70482; X-591-73-69) Avail: NTIS HC $17.75 CSCL 14B

The minitrack tracking function is described and specific operations are identified. The subjects discussed are: (1) preprocessor listing, (2) minitrack hardware, (3) system calibration, (4) quadratic listing, and (5) quadratic flow diagram. Detailed information is provided on the construction of the tracking system and its operation. The calibration procedures are supported by mathematical models to show the application of the computer programs. P.N.F.

**N73-33157#** School of Aerospace Medicine, Brooks AFB, Tex.
**A CRITICAL ASSESSMENT OF GROUND-BASED DEVICES FOR SPATIAL ORIENTATION TRAINING Preliminary Report, Sep. 1972 - Apr. 1973**
Patrick J. Dowd Aug. 1973 18 p refs
(AF Proj. 7930)
(AD-764740; SAM-TR-73-23) Avail: NTIS CSCL 05/9

Comparisons are made of selected orientation training devices in relation to U.S. Air Force flight training in the T-38 airplane. Assessment categories are: motion parameters, illusions that each device can generate, type of instrumentation available to the pilot-subject in relation to attitude and control, reaction capability provided in each device for the subject to recover or correct his attitude, capability to measure and evaluate the subject's performance in coping with disorienting maneuvers, invulnerability to weather, safety, and initial and operating costs. The USAFSAM spatial orientation trainer (SOT) far excels all other ground-based devices for both hardware- and pilot-oriented assessment criteria. The use and need of a SOT-type trainer are discussed. Author (GRA)

**N73-33764** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).
**FLOAT SUPPORT NECESSARY TO CAPTURE SOLAR RADIATION [DU SUPPORT FLOTTANT NECESSAIRE A LA CAPTATION DU RAYONNEMENT SOLAIRE]**
S. Leonard *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 9-10 In FRENCH (For availability see N73-33762 24-29)

**N73-33768** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).
**ARID ZONE CULTIVATION AND GREENHOUSES-SOLAR DISTILLERS [CULTURES EN ZONE ARIDE ET SERRES-DISTILLATEURS SOLAIRES]**
H. Boutiere *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 35-56 In FRENCH (For availability see N73-33762 24-29)

**N73-33769** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).
**SOLAR STILL GREENHOUSE: A PROPOSAL FOR USING DESALINATED WATER FOR AGRICULTURAL PURPOSES**
Van-Vi Tran, M. Kudret Selcuk, Mehmet Akyurt, Mehdi Shariat, Ustuen Oztoker, and Necdet Toraman *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 57-68 refs (For availability see N73-33762 24-29)

# 12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

**N73-33158** Missouri Univ., Rolla.
**TIME RESOLVED MEASUREMENTS OF DROPLET GROWTH IN A WILSON CLOUD CHAMBER Ph.D. Thesis**
Micheal Anthony Vietti 1972 116 p
Avail: Univ. Microfilms Order No. 73-17068

The growth rates of water drops in a Wilson expansion cloud chamber are measured with air, argon, and helium as the carrier gas, in the size range of .5 to 10 microns. The drops growing in the supersaturated chamber exhibit oscillations in the scattered intensity as predicted by the Mie theory. Scattered intensity is measured at 30 degrees to the He-Ne laser beam. Supersaturation ratios during growth range from S = 1.2 to S = 3.5 for all three gases. The initial temperature is measured and the pressure is monitored continuously so that droplet growth theory can be compared with the experiment. Three droplet growth theories are examined, two of the theories used the sticking coefficient alone as a parameter, while the third used both sticking and thermal accommodation coefficients. The thermal accommodation coefficient was greatest for air and smallest for helium. Dissert. Abstr.

**N73-33159** Clarkson Coll. of Technology, Potsdam, N.Y.
**KINETICS OF AEROSOL GROWTH Ph.D. Thesis**
Siamak Shahriari 1972 210 p
Avail: Univ. Microfilms Order No. 73-14853

The kinetics of growth of a dibutylphthalate aerosol is examined in a flow reactor. A hot carrier gas containing dibutylphthalate vapor is jacketed with pure carrier gas by using two concentric, cylindrical tubes of which only the inner one contains the condensing vapor. Both gases exit simultaneously into the atmosphere, and by proper regulation of the flow rates it is possible to maintain a stable, non turbulent jet suitable for study along the growth zone of the aerosol by light scattering methods. Both the changing modal particle size and the polydispersity of the aerosol can be followed as a function of time. The results are interpreted in terms of the theory of transport processes in gases. Dissert. Abstr.

**N73-33160** Case Western Reserve Univ., Cleveland, Ohio.
**SWIRLING, ANNULAR, GAS-LIQUID FLOW DOWN A VERTICAL TUBE Ph.D. Thesis**
Julian Mark Tishkoff 1973 242 p
Avail: Univ. Microfilms Order No. 73-16168

Experiments were conducted for the flow of air and water at room temperature down a vertical, six-foot-long, 1-1/8 inch inner diameter plastic tube. At the upper end of this tube an annular flow of water coated the inner wall in a film surrounding the airflow. Downstream, droplets of water from the film became entrained in the airstream. Both the air and water could be injected into this test section with or without swirl. The experimental data indicate that the thickness of the water film which represents steady-state wetting of the containing wall is significantly increased when swirl is generated directly in the film as compared with nonswirling flow. Results indicate that the onset of liquid droplet entrainment is not correlated with liquid film destruction. Dissert. Abstr.

**N73-33161** Clarkson Coll. of Technology, Potsdam, N.Y.
**AN EXPERIMENTAL STUDY OF THE STRUCTURE OF THE PULSATING TURBULENT FLOW OF AIR IN A CIRCULAR PIPE Ph.D. Thesis**
Mahmood Mohajery 1973 241 p
Avail: Univ. Microfilms Order No. 73-14852

The objective of the experimental investigation was to study the influence of periodic oscillations imposed on the mean flow upon the mean and turbulent structure of a fully developed air flow in a smooth circular pipe. In the range of the parameters considered, the long time average mean velocity appears to be identical to the mean velocity in the steady flow case. The pulsating component of the mean velocity depends strongly on the Reynolds Number and the frequency parameter, and is linearly related to the pulsating pressure gradient. Small increases in the turbulent kinetic energy and the Reynolds stress are observed in the pulsating flow relative to the steady flow case. The increases are larger near the pipe wall and depend on the pulsation amplitude. Dissert. Abstr.

**N73-33162** Utah Univ., Salt Lake City.
**VISCOUS-FLOW HEAT TRANSFER IN CURVED TUBES Ph.D. Thesis**
Charles Edward Kalb 1973 378 p
Avail: Univ. Microfilms Order No. 73-16420

Heat transfer to steady viscous flow in curved tubes of circular cross section was studied theoretically for fully developed velocity and temperature fields under two thermal boundary conditions--uniform wall temperature and axially uniform wall heat flux with peripherally uniform wall temperature. The fully developed velocity profiles utilized were obtained by numerical solution of the full continuity and Navier-Stokes equations for a constant property fluid. The thermal energy equation was solved numerically by use of a point successive-overrelaxation method. The solutions were not limited to large curvature ratios (radius of bend/inside radius of tube), thereby shedding light on the effect of the curvature ratio over that expressed in the Dean number. The numerical results should prove useful in the design of many types of heat transfer devices and nonadiabatic reactors employing curved circular passages. Design correlations are presented in the form of equations and graphs. The results also have potential applications to mass transfer, particularly in bioengineering systems. Dissert. Abstr.

**N73-33163** Illinois Univ., Urbana.
**THERMOCONVECTION IN A BOUNDED CYLINDRICAL FLUID LAYER Ph.D. Thesis**
Gary Samuel Charlson 1972 194 p
Avail: Univ. Microfilms Order No. 73-17149

An analytic study is made of natural convection induced in a cylindrical layer of fluid by uniform heating from below. The fluid layer is bounded laterally by a solid right circular cylinder with the cylinder height to radius ratio a variable. The fluid layer is bounded above and below by solid isothermal plates. The thermal conditions imposed at the lateral surface correspond to either a perfectly conducting or insulating wall. Solutions to the corresponding set of governing equations subject to the Boussinesq approximations and coupled with the appropriate set of boundary conditions are sought in order to investigate the effect of the necessary lateral wall on thermoconvection. Dissert. Abstr.

**N73-33164** Clemson Univ., S.C.
**INCREASED TURBULENT DISPERSION IN DILUTE HIGH POLYMER DRAG REDUCING OPEN CHANNEL FLOW Ph.D. Thesis**
Jerald Paul Peterson 1972 117 p
Avail: Univ. Microfilms Order No. 73-19265

Because of the importance of dispersion in pollution control, it was proposed to experimentally study the effect of high polymer drag reducing additives on the longitudinal turbulent dispersion coefficient for two-dimensional open channel flow. Also, the characteristics of drag reduction were studied for both supercritical and subcritical flow. Theoretical analysis showed that the dispersion coefficient should be greatly enhanced in a drag reducing flow. A Plexiglass variable slope flume with a length of twenty-nine feet and a width of six inches was used for the study. The primary polymer additive used was Separan AP30. Two different slopes which produced supercritical flow, as well as one slope which produced subcritical flow, were studied. It was found that drag reduction can be readily obtained in supercritical flow, but in subcritical flow the onset shear stress is not easily attained. The data obtained for the longitudinal turbulent dispersion coefficient in two-dimensional drag reducing flows indicated that the dispersion coefficient increased with increasing polymer concentration for dilute polymer solutions at a given Reynolds number. Dissert. Abstr.

**N73-33165** Rochester Univ., N.Y.
**HYDRODYNAMIC STABILITY OF AXISYMMETRIC FREE SHEAR LAYERS Ph.D. Thesis**
Pawan Jit Singh 1973 141 p
Avail: Univ. Microfilms Order No. 73-14836

The stability of laminar axisymmetric jets and wakes, the two prominent examples of free shear layers, is investigated with respect to linear azimuthally periodic disturbances. The well-known similar mean velocity distributions for the submerged swirlfree jet and the far-wake are examined although the investgation is general enough as to accept any velocity profile. The stability equations are derived by introducing small three-dimensional azimuthally periodic wavy disturbances in the mean flow; these equations and the specified homogeneous boundary conditions constitute an eigenvalue problem. The equations are integrated numerically using the Taylor series method. As the equations are regularly singular at radius $r=0$, the Frobenius power series solutions are obtained near $r=0$ to start the integration. The eigenvalues are determined by matching the numerically advanced solutions to the asymptotic solutions at a large radius. The asymptotic solutions are determined either by disregarding the small value of the mean velocity at large radius and solving the equations exactly in terms of modified Bessel functions or more accurately, by assuming asymptotic power series solutions and finding the coefficients in the series. Dissert. Abstr.

**N73-33166** New York Univ., N.Y.
**ANALYSIS OF AN ENTRAINMENT MODEL OF THE JET IN A CROSSFLOW Ph.D. Thesis**
Hsiang-Sheng Chang 1972 90 p

Avail: Univ. Microfilms Order No. 73-19379

A theoretical model was proposed for the problem of a round jet in an incompressible cross flow. The method of matched asymptotic expansion was applied to this problem. Inner and outer expansions were obtained in terms of an expansion parameter for the solution to the flow problem in the inner region, the re-entrant wake flow model was used with the reentrant flow representing the fluid entrained by the jet. Higher order corrections are obtained in terms of this basic solution. The perturbation terms in the outer region were found to be a line distribution of doublets and sources. The line distribution of sources represents the combined effect of the entrainment and the displacement. Pressure coefficient contours for .25, .5, and .8 were computed for inner and outer region. The variation of jet radius, source strength, and mean jet velocity as functions of distance along the jet trajectory were also computed to aid in assessing the role of these quantities in the interaction.

Dissert. Abstr.

**N73-33167** Texas Univ., Austin.

**HEAT TRANSFER AND WAVELENGTH MEASUREMENT FOR AXISYMMETRIC FLOW OF A FLUID HEATED FROM BELOW Ph.D. Thesis**

Priros Georgios Pallas 1972 111 p

Avail: Univ. Microfilms Order No. 73-18477

The heat transfer and wavelength of convective motions in a thin fluid layer heated from below is described. The pattern of the convective motions is also investigated qualitatively. The apparatus consists of a cylindrical fluid container whose unique design allows visual observation and heat transfer measurements simultaneously. It is shown that the presence of the laternal boundaries causes subcritical rolls to form. The boundaries have an influence on the direction of the flow at the flow at the rim. Subcritical motions do not affect the heat transfer rate which remains the same as that given by the linear conduction law. The heat transfer rate increases substantially and steadily as the Rayleigh number is increased and so does the wavelength. The initial slope of the heat transfer rate of circular rolls versus Rayleigh number is investigated and is found to be 1.48 and is identical for all fluids whose Prandtl number is greater than 100.

Dissert. Abstr.

**N73-33168** Virginia Univ., Charlottesville.

**ANALYSIS OF MERGED LAYER REGIME ON A SHARP CONE AT ZERO INCIDENCE Ph.D. Thesis**

Santosh Kumar 1973 96 p

Avail: Univ. Microfilms Order No. 73-18973

Hypersonic low density flow past a semi-infinite sharp cone is studied. Only the merged layer regime is considered. Motivation for the study was to extend the two-layer formulation to non-similar solution cases. The shock structure problem is treated within the Navier-Stokes formulation while the viscous layer was taken to be non-similar and of the boundary layer type. For the shock structure problem, analytical expressions are obtained for the following quantities to zeroth order in inverse Reynolds' number: (1) conservation of mass flux across the viscous layer-shock wave interface, (2) numerical matching of normal gradients in velocity resulting from the curved shock and from the viscous layer, and (3) numerical matching of state variables and velocity components at the shock-viscous layer interface.

Dissert. Abstr.

**N73-33169** University of Southern Calif., Los Angeles.

**VORTEX PAIRING IN A TURBULENT SHEAR LAYER AT MODERATE REYNOLDS NUMBERS Ph.D. Thesis**

Clinton D. Winant 1973 116 p

Avail: Univ. Microfilms Order No. 73-18850

A shear layer is formed by bringing two streams of water moving at different velocities together in a lucite walled channel. The Reynolds number, based on the velocity difference and the thickness of shear layer, varies from 30 where the shear layer originates, to 1200. Dye is injected between the two streams, just before they are brought together, marking the vorticity carrying fluid. After the initial small waves are formed, the dyed fluid is observed to roll up into discrete vortices. These vortices interact by rolling around each other, and a single vortical structure with approximately twice the wavelength of the former vortices, is formed. This pairing process is observed to occur repeatedly, controlling the growth of the shear layer. A simple model based on these observations predicts a turbulent shear layer growth rate which is in good agreement with available experimental measurements. Velocity fluctuations at several stations across an ensemble averaged vortical structure are presented.

Dissert. Abstr.

**N73-33170** Minnesota Univ., Minneapolis.

**THE FLUID MECHANICS OF THE HOLE TONE Ph.D. Thesis**

Ram Kumar Matta 1973 171 p

Avail: Univ. Microfilms Order No. 73-18133

The hole tone is a whistle which has been empirically developed as an efficient producer of discrete frequency sound. Two parallel plates with an orifice in each are situated a short distance apart. The jet formed by fluid flow through one orifice impinges centrally on the second orifice and, under certain conditions, gives rise to a pure tone. The sound is aerodynamically generated. The mechanism involves symmetric disturbances of the jet and vortex ring formation in the vortex sheet surrounding the free jet. A model is postulated to show how the energy of a free jet is converted into acoustically radiated energy. According to the model, a periodic disturbance is imposed on the jet at exit from the upstream orifice, resulting in the formation of a vortex ring street. The rings propagate downstream and interact with the second orifice-plate giving rise to a periodic flow through the orifice. This unsteady flow is the source of sound and also provides the perturbation at the upstream orifice which triggers the instability of the jet. The analytic model is found to correctly predict the qualitative characteristics of the hole tone and quantitative characteristics such as the tone frequency and pressure amplitude.

Dissert. Abstr.

**N73-33171** Illinois Univ., Urbana.

**APPLICATION OF THE KINETIC THEORY APPROACH TO PROBLEMS IN GAS DYNAMICS Ph.D. Thesis**

William Pace Walters 1972 133 p

Avail: Univ. Microfilms Order No. 73-17464

Several problems are dealt with on the application of the kinetic theory approach to complex gas dynamics problems under conditions far from thermal equilibrium. Nordsieck invented a Monte Carlo method of accurately evaluating the Boltzmann collision integral which has led to the development of a method of solving numerically the Boltzmann equation for several gas dynamics problems. The accuracy of Nordsieck's method was established by comparing the numerical results with an analytical calculation for a bimodal distribution function. The analytical calculation was extended to binary gas mixtures, including those of electrons and neutral gases, with bimodal distribution functions. An expression was developed for the differential collision cross-section for the inverse fourth power intermolecular potential (corresponding to that of Maxwellian molecules) suitable for numerical evaluation in Nordsieck's method. Comparative study of the shock wave solutions of Maxwellian molecules with those of rigid elastic spheres yields a basic description of the effect of intermolecular collision law on the internal shock structure.

Dissert. Abstr.

**N73-33172** University of Southern Calif., Los Angeles.

**THEORY OF SHOCK SUPPORTED ARRHENIUS REACTIONS AND IGNITION DELAY Ph.D. Thesis**

Dale Allen Beckstead 1973 155 p

Avail: Univ. Microfilms Order No. 73-18795

The steady flow of a chemically reacting gas downstream of a strong shock wave is studied under the assumption that epsilon = KT sub s/E sub a is much less than 1. An explicit analytical solution to the reaction zone structure is developed using the method of matched asymptotic expansions with epsilon as the principle expansion parameter. Solutions are developed simultaneously for both endothermic and exothermic reactions in a one-dimensional inviscid fluid. The solution assumes a single step irreversible chemical reaction of arbitrary order and number of reactants and products. A description is given of the dependence of epsilon on the reaction zone structure, and an examination is made of the effect of a small epsilon on the existence of an induction zone. It was found that the structure of endothermic and exothermic reactions which do not have a maximum temperature between the initial and final states, consists of three

analytically different zones: induction, main reaction, and terminal. Dissert. Abstr.

**N73-33173** Texas Univ., Austin.
**A STUDY OF THE FLOW FIELD PRODUCED BY AN AXISYMMETRIC, UNDEREXPANDED JET EXHAUSTING INTO A CYLINDRICAL TUBE Ph.D. Thesis**
James Lucian Batson 1972 119 p
Avail: Univ. Microfilms Order No. 73-18399

An investigation, which was primarily of an experimental nature, was undertaken to define the flow field produced when an underexpanded jet is exhausted from a conical nozzle into a cylindrical tube. The experimental data included the reservoir conditions for the nozzle, the static pressure distribution along the cylinder wall, pitot probe surveys at the cylinder exit, and photographs of the flow exhausting from the tube. Of principal concern were the effects on the flow field of tube length, of reservoir conditions, and of test time. Although room temperature nitrogen was used as the test gas in most of the tests, several tests used actual rockets statically fired into the same cylindrical tubes. The experimentally determined flow field characteristics were compared with the experimental data of others, with a method of characteristics analysis developed for the present investigation, and with the flow field model of Fabri and Siestrunck. Dissert. Abstr.

**N73-33174** Johns Hopkins Univ., Baltimore, Md.
**EXPERIMENTS ON THE NEARLY ISOTROPIC TURBULENCE BEHIND A JET GRID Ph.D. Thesis**
Mohamed Abo-El-Fath Mohamed Gad-El-Hak 1973 231 p
Avail: Univ. Microfilms Order No. 73-16642

Wind tunnel turbulence behind a parallel rod grid with jets evenly distributed along each rod is nearly isotropic. Homogeneity improvement over prior related experiments was attained by the use of controllable nozzles. Compared with the passive case, the downwind-jet active grid gives smaller static pressure drop across it and smaller turbulence level at a prescribed distance from it, while the upwind-jet grid gives larger static pressure drop and larger turbulence level. Counterflow injection apparently increases the effective solidity, causing instability, larger turbulent energy and larger scales. If the inverse turbulent kinetic energy is approximated as a power law of distance, the exponent decreases with increasing downwind or upwind jet strength, corresponding to slower decay rates. No peculiar decay behavior occurs when the grid is self-propelled (net average force on it = 0), or when the static pressure drop across it is zero. The injection does not change the general behavior of the energy spectra although the absolute spectra changes in as much as the turbulence kinetic energy changes. Dissert. Abstr.

**N73-33175** Catholic Univ. of America, Washington, D.C.
**ON THE ROLE OF PHYSICAL PROPERTIES OF LIQUIDS IN CAVITATION EROSION Ph.D. Thesis**
Sung Tung 1973 98 p
Avail: Univ. Microfilms Order No. 73-19025

Cavitation erosion as a severe problem in high-speed flow systems is discussed. Attempts to avoid cavitation greatly need the development of modeling test techniques. The role of physical properties of liquids on cavitation erosion with the objective to provide useful information for the development of such modeling laws was investigated. A series of systematic erosion damage experiments utilizing the vibratory test method are conducted on aluminum in water-alcohol mixtures to study the effect of exposure time on the erosion rate. The theoretical investigation is initiated from the idea that the output of cavitation as seen by experiments is proportional to the input to the erosion process, which then relates the intesnity of erosion to the intensity of bubble collapse. A general theory of the intensity of erosion has been established as functions of density, sound speed, surface tension, vapor pressure, and air content. Dissert. Abstr.

**N73-33176** Colorado State Univ., Fort Collins.
**STUDY OF TURBULENT DIFFUSION FROM A GROUND RELEASED PUFF BY A LASER LIGHT-SCATTERING METHOD Ph.D. Thesis**
Bing-Tsuen Yang 1972 232 p
Avail: Univ. Microfilms Order No. 73-13056

The behavior of an instantaneous point source, as it disperses in a thick, neutrally stratified, turbulent shear layer, was examined by a laser light-scattering technique in a meteorological wind tunnel. An aerosol-filled gas bubble was released in a column of water to subsequently rise and burst at the floor of the wind tunnel. This pseudo-instantaneous gas volume dispersed in the turbulent shear layer. Time dependent concentrations at a point were monitored by measuring the scattered light from a coherent light source by a photomultiplier-fiber optics probe. Data consisted of a series of concentration realizations downstream from the ground level source. The distribution of concentration was described by selecting coefficients empirically in a Gram-Charlier series. Puff dispersion characteristics were compared with prediction of the Lagrangian similarity diffusion theory. Dissert. Abstr.

**N73-33177#** Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
**THE INSTANTANEOUS STRUCTURE OF THE WALL PRESSURE UNDER A TURBULENT BOUNDARY LAYER FLOW**
R. Emmerling Jul. 1973 76 p refs Transl. into ENGLISH of an extended version of "Mitteilungen aus dem Max-Planck-Institut fuer Stroemungsforschung und der Aerodynamischen Versuchsanstalt" Goettingen, no. 56, 1973
(Rept-9/1973) Avail: NTIS HC $6.00

An optical method was used to investigate the instantaneous structure of the wall pressure under a turbulent boundary layer flow in air. The optical apparatus consisted basically of a Michelson-Interferometer. One mirror of the interferometer was replaced by a reflecting flexible wall, which was also part of the wall bounding the flow being investigated. The turbulent wall pressure fluctuations cause the flexible wall to be displaced by several light wavelengths. The optical method used made it possible to determine the instantaneous values of the wall pressure distribution, the convection velocity and the wall pressure gradient. The most important results of this investigation are as follows: At random time intervals, zones of high-amplitude wall pressure fluctuations appear. The wall pressure extrema inside these zones travel downstream with an instantaneous convection velocity, gradually changing in form. These wall pressure extrema can be followed downstream. Wall pressure peaks occur with both positive (overpressure) and negative (underpressure) signs. Author

**N73-33178#** Defence Research Establishment Valcartier (Quebec).
**DENSITY AND TEMPERATURE DISTRIBUTIONS IN HYPERSONIC SPHERE WAKES**
J. G. G. Dionne and L. Tardif Dec. 1972 29 p refs
(DREV Proj. 95-51-10)
(DREV-R-683/72) Avail: NTIS HC $3.50

The radial and axial dependence of the mass density distributions in both the laminar and the turbulent wakes of 1.0 and 2.7 in diam spheres at Mach 13.5 in a nitrogen atmosphere were measured using an electron beam fluorescence probe. The distribution of temperature on the wake was also inferred by assuming that the wake is isobaric. Both the mass and temperature distributions in the wake may be characterized by the behavior of two parameters: (1) the amplitude of the mass density, or (2) the temperature distributions on the centerline of the wake. Experimental data are presented for these parameters. Author

**N73-33179*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ASSESSMENT OF JETS AS ACOUSTIC SHIELDS BY COMPARISON OF SINGLE- AND MULTITUBE SUPPRESSOR NOZZLE DATA**
Vernon H. Gray, Orlando A. Gutierrez, and David Q. Walker 1973 21 p refs Presented at the Aeroacoustic Specialists Conf., Seattle, 15-17 Oct. 1973; sponsored by AIAA
(NASA-TM-X-71450; E-7690) Avail: NTIS HC $3.25 CSCL 20D

Recent 1/4 scale and engine size nozzle acoustic data, for both 37-tube and single nozzles, were used to test the jet-shielding principle. At low jet velocities the multitube nozzle total sound power approaches the equivalent of 37 single tubes (no shielding), while near-sonic and above, the small equivalent number of single tubes compares well with a geometric model of lateral radiation from only about a third of the circumference of the outer jets

(nearly complete shielding). At high jet velocities, the geometric shielding hypothesis is in excellent agreement with acoustic data from which the downstream coalesced jet noise is excluded. Present results are compared with an existing correlation for single jets, and with previous publications on multijet shielding.
Author

**N73-33180*#** Kanner (Leo) Associates, Redwood City, Calif.
**DEFLECTION OF A FREE FLUID JET AT A FLAT PANEL**
W. Schach Washington NASA Oct. 1973 39 p refs Transl. into ENGLISH from Ing.-Arch. (Berlin), v. 5, 1934 p 245-265 (Contract NASw-2481)
(NASA-TT-F-15151) Avail: NTIS HC $4.00 CSCL 20D

Prandtl's hodograph method is used to calculate the free jet boundary and distribution of flow within a planar jet and pressure distribution along the panel upon which it impinges. A setup is described with which pressure distribution over the panel, curves for vertical jet pressure, and its point of application are determined experimentally for comparison with theory. Jet pressure is also checked directly by weighing. Agreement is very good. For constant jet thickness over the panel, pressure distribution along the panel and jet pressure vary as the square of jet velocity and linearly as the sine of panel inclination. The pressure distribution over a panel deflecting a circular jet is determined experimentally at the same panel angles as for the planar jet. Stagnation point, stagnation pressure, jet pressure and its point of application are calculated; jet pressure is also determined by weighing.
Author

**N73-33181*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**ON THE RELATIONSHIP BETWEEN ACOUSTIC ENERGY DENSITY FLUX NEAR THE JET AXIS AND FAR FIELD ACOUSTIC INTENSITY**
Lucio Maestrello Washington Oct. 1973 64 p refs
(NASA-TN-D-7269; L-8871) Avail: NTIS HC $3.00 CSCL 20D

By measurement and analysis, the relationship between the distribution of the outflow of acoustic energy over the jet boundary and the far-field intensity is considered. The physical quantity used is the gradient of the pressure evaluated on a geometrical plane at the smallest possible radial distance from the jet axis, but outside the vortical region, in the area where the homogeneous wave equation is reasonably well satisfied. The numerical and experimental procedures involved have been checked out by using a known source. Results indicate that the acoustic power output per unit length of the jet, in the region from which the sound emanates, peaks at approximately 9 diameters downstream. The acoustic emission for a jet Strouhal number of about 0.3 exceeds the emission for all other Strouhal numbers nearly everywhere along the measurement plane. However, the far-field peak intensity distribution obtained from the contribution of each station was found to depend on the spatial extent of the region where sound emanates from the jet, which, in turn, depends more on the far-field angle than on the Strouhal number.
Author

**N73-33182*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**PILOT MODEL EXPANSION TUNNEL TEST FLOW PROPERTIES OBTAINED FROM VELOCITY, PRESSURE, AND PROBE MEASUREMENTS**
Wilfred J. Friesen and John A. Moore Washington Nov. 1973 108 p refs
(NASA-TN-D-7310; L-8846) Avail: NTIS HC $4.25 CSCL 20D

Velocity-profile, pitot-pressure, and supplemental probe measurements were made at the nozzle exist of an expansion tunnel (a modification to the Langley pilot model expansion tube) for a nozzle net condition of a nitrogen test sample with a velocity of 4.5 km/sec and a density 0.005 times the density of nitrogen at standard conditions, both with the nozzle initially immersed in a helium atmosphere and with the nozzle initially evacuated. The purpose of the report is to present the results of these measurements and some of the physical properties of the nitrogen test sample which can be inferred from the measured results. The main conclusions reached are that: the velocity profiles differ for two nozzle conditions; regions of the flow field can be found where the velocity is uniform to within 5 percent and constant for several hundred microseconds; the velocity of the nitrogen test sample is reduced due to passage through the nozzle; and the velocity profiles do not significantly reflect the large variations which occur in the inferred density profiles.
Author

**N73-33183#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**ANALYSIS OF THE SUPERSONIC GAS FLOW AROUND THE ATMOSPHERE ON A SPHERICAL BODY**
V. Ia. Mitnitskii [1973] 6 p refs Transl. into ENGLISH from Vychisl. Matem. i Matem. Fiz. (USSR), v. 13, no. 4, 1973 p 1060-1064
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The supersonic stationary flow around an atmosphere retained by the gravitational force of a spherical body is examined. It is assumed that the external flow is separated from the atmosphere at rest by a tangential discontinuity. A numerical method is developed which affords the possibility of determining the shape of the tangential discontinuity and shock wave in addition to the flow parameters in the shock layer.
Author

**N73-33184*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**CALCULATION PROCEDURES FOR POTENTIAL AND VISCOUS FLOW SOLUTIONS FOR ENGINE INLETS**
J. A. Albers and N. O. Stockman [1973] 34 p refs Proposed for presentation at 1974 Intern. Gas Turbine Conf., Zurich, 31 Mar. - 4 Apr. 1974; sponsored by ASME
(NASA-TM-X-71457) Avail: NTIS HC $3.75 CSCL 20D

The method and basic elements of computer solutions for both potential flow and viscous flow calculations for engine inlets are described. The procedure is applicable to subsonic conventional (CTOL), short-haul (STOL), and vertical takeoff (VTOL) aircraft engine nacelles operating in a compressible viscous flow. The calculated results compare well with measured surface pressure distributions for a number of model inlets. The paper discusses the uses of the program in both the design and analysis of engine inlets, with several examples given for VTOL lift fans, acoustic splitters, and for STOL engine nacelles. Several test support applications are also given.
Author

**N73-33185#** Royal Aircraft Establishment, Farnborough (England).
**THE KUTTA-JOUKOWSKY CONDITION IN THREE DIMENSIONAL FLOW**
Robert Legendre Jul. 1973 22 p refs Transl. into ENGLISH from Rech. Aerosp. (France), v. 5, 1972 p 241-248 Presented at 13th Congr. of IUTAM, Moscow, Aug. 1972
(RAE-Lib-Trans-1709; BR36990) Avail: NTIS HC $3.25

The separation line along which a vortex sheet is attached to a wing is not always limited to the conventional trailing edge. It may extend to the wing tips and even to parts of the leading edges. In the light of observations of the flow over models of marine propellers and delta wings, a discussion is initiated, aimed at improving the description of the flow over an arbitrary wing, with a view to formulating a better basis for an accurate calculation of the flow of an ideal fluid, as a point of reference for the consideration of real flows.
Author

**N73-33186#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Hauptabteilung Wissenschaft und Technik.
**PAPERS ON FLUID DYNAMICS WITH EMPHASIS ON BOUNDARY LAYER THEORY, PART 1**
9 Mar. 1972 218 p refs Partly in GERMAN and partly in FRENCH; ENGLISH summaries
(DLR-FB-72-26) Avail: NTIS HC $13.00; DFVLR, Porz, West Ger. 44,90 DM

Topics in the field of fluid dynamics are presented, with special emphasis on the boundary layer theory. The wind tunnel measurements of a wing profile with leading edge sheets and trailing edge flaps are reported. The secondary flow in the gap between two concentric cylinders was investigated. The flow of viscous and heat conducting gas with a sine wave wall perturbation was considered. The interaction between solid particles and a gas in turbulent boundary layer flow is also

discussed. For individual titles, see N73-33187 through N73-33201.

**N73-33187** Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
**EXPERIMENTAL STUDY OF WING PROFILE WITH FOWLER FLAPS AND SLATS [EXPERIMENTAL-STUDIE AN EINEM PROFIL MIT FOWLERKLAPPE UND VORFLUEGEL] c01**
Juergen Barche *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 7-44 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

Aerodynamic forces, pressure distribution, and wake of a wing profile with leading edge slats and trailing edge flaps were measured in a subsonic wind tunnel (maximum velocity of over 70 m/s). The measurements were performed to establish a theory on high lift devices for takeoff and landing. To this end, in addition to the classic representation of test results, special plots were drawn to indicate the conditions in separated flow ranges. ESRO

**N73-33188** Technische Hochschule, Darmstadt (West Germany). Fachbereich Mechanik.
**SECONDARY FLOW ON THE FREE SURFACE OF A NEWTONIAN LIQUID BETWEEN ROTATING CYLINDERS [SEKUNDAERSTROEMUNG AN DER FREIEN OBERFLAECHE EINER NEWTONSCHEN FLUESSIGKEIT ZWISCHEN ROTIERENDEN ZYLINDERN]**
Ernst Becker, Hans Buggisch, and Juergen Welter *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 45-59 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

The secondary flow was investigated near the free surface of a Newtonian liquid that fills the gap between two vertically aligned concentric cylinders rotating with different angular velocities. This phenomena is of importance to the extruding of plastic fibers or bars, and the coating of metal wires with insulating material. The investigated effect is explained by means of a simple shear flow. The basic equations for Couette flow between the concentric cylinders was setup, and solved for the secondary flow. The horizontal and vertical flow velocity distributions were determined. ESRO

**N73-33189** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
**PERIODIC PERTURBATIONS OF A PARALLEL DISSIPATIVE GAS FLOW [PERIODISCHE STOERUNGEN DER PARALLELSTROEMUNG EINES DISSIPATIVEN GASES]**
Klemens Burg *In its* Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 60-69 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

The flow of a viscous and heat conducting gas in a flat channel with a sine wave wall was considered. The problem was reduced to a boundary value problem for a nonlinear partial differential equation of the third order. A projectional method was used to get approximate solutions. ESRO

**N73-33190** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
**BOUNDARY LAYER FLOW OF GAS-SOLID SUSPENSIONS [ZUR WANDNAHEN STROEMUNG VON GAS-FESTSTOFFSUSPENSIONEN]**
Fritz Ebert *In its* Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 1 9 Mar. 1972 p 70-77 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

The interaction between solid particles and a gas in turbulent boundary layer flow is discussed. The increase in the dissipation of energy due to the presence of particles was estimated for low solids loading. The problem was found in pneumatic transportation, particle separation in centrifuges, and powder classification in flow sorters. ESRO

**N73-33191** Laval Univ. (Quebec). Dept. of Genie Mecanique.
**PRESSURE DISTRIBUTION AND TURBULENCE ANISOTROPY IN BOUNDARY LAYERS, WAKES, FREE AND WALL JETS [IMPORTANCE DES VARIATIONS DE LA PRESSION ET DE L'ANISOTROPIE DES FLUCTUATIONS TURBULENTES DANS LES COUCHES LIMITES, LES SILLAGES, LES JETS LIBRES ET PARIETAUX]**
Ernest A. Eichelberger and Pierre R. Florent *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 78-101 refs In FRENCH; ENGLISH summary (For availability see N73-33186 24-12)

The effects of lateral turbulent anisotropy on pressure distribution and secondary velocity components were investigated and graphically represented in the cases of three dimensional influences on boundary layers with and without pressure gradients, free jets or wall jets, and wakes. The configurations are plane flow as well as revolution symmetrical flow. ESRO

**N73-33192** Technische Univ., Berlin (West Germany). Inst. fuer Ueberschalltechnik.
**APPROXIMATION SOLUTIONS FOR LAMINAR BOUNDARY LAYERS AT CONTINUOUSLY MOVING WALLS [NAEHERUNGSLOESUNGEN FUER LAMINARE GRENZSCHICHTPROBLEME BEI KONTINUIERLICH BEWEGTER WAND]**
Heinrich Eickhoff *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 102-110 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

Laminar boundary layers at a continuous moving sheet and behind a shock wave were investigated. With a suitably chosen coordinate system, the two cases were reduced to the same problem. The solution is derived by an analytic approximation method. The problem was treated by considering the shear stress, the heat transfer, and the evaporation of a fuel covered wall of shock tube, in which combustion takes place. The method is based on linearization of the boundary layer equations reduced to ordinary differential equations. ESRO

**N73-33193** Technische Univ., Berlin (West Germany). Inst. fuer Ueberschalltecknik.
**INVESTIGATION ON THE OBTAINABLE FRICTION FORCES IN SUPERSONIC NOZZLES ON PNEUMATICALLY DRAWN FIBERS [UNTERSUCHUNG UEBER DIE IN UEBERSCHALLDUESEN ERZIELBAREN REIBUNGSKRAEFTE BEIM PNEUMATISCHEN ZIEHEN]**
Heinrich Eickhoff and Bernhard Gampert *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 111-124 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

Large friction forces are necessary in the process of fiber production from thermoplastic material between the fiber and the surrounding flow. The effect of supersonic flow on these forces are investigated. Calculations were based on boundary layer theory. The shear stress of the fiber was determined from a difference method. The incompressible flow for constant nozzle exhaust velocity, as well as the compressible flow neglecting transversal curvature was then calculated. The results of the difference method are discussed. ESRO

**N73-33194** Karlsruhe Univ. (West Germany). Inst. fuer Stroemungslehre und Stroemungsmaschinen.
**TURBULENT SHEAR STRESS IN BOUNDARY LAYERS AT PERIODIC STATIONARY FREE FLOW PRESSURE PERTURBATIONS [DIE TURBULENTE SCHUBSPANNUNG IN GRENZSCHICHTEN BEI PERIODISCHEN STATIONAEREN STOERUNGEN DER AUSSENGESCHWINDIGKEIT]**
K. O. Felsch and R. Dechow *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 125-134 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

The behavior of a turbulent flat plate boundary layer at small periodic perturbations of the free stream pressure was studied experimentally. In particular, the influence of these perturbations on the shape of the shear stress profiles was investigated. The investigations were carried out in a small boundary layer wind channel over a trajectory of 2m. A wooden sonic wave wall was used to produce the periodic pressure perturbations. ESRO

**N73-33195** Cambridge Univ. (England). Dept. of Engineering.
**EFFECT OF HEAT TRANSFER ON VELOCITY DISTRIBUTION AND SKIN FRICTION IN TURBULENT WALL BOUNDARY LAYERS [DER EINFLUSS DES WAERMEUEBERGANGS**

**AUF DAS GESCHWINDIGKEITSPROFIL UND DIE WANDREIBUNG IN TURBULENTEN WANDGRENZSCHICHTEN]**
H. Frenholz *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 135-140 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

The effect of heat transfer on the velocity profile and skin friction was investigated in two-dimensional turbulent boundary layers with small Mach number and zero pressure gradient. Comparing the semiempirical relationships with measurements in highly cooled boundary layers gives good agreement between theory and experiment. ESRO

**N73-33196** Lutravil Spinnvlies G.m.b.H. and Co., Kaiserslautern (West Germany).
**STRUCTURE OF AERODYNAMICALLY SPUN NON-WOVEN FABRICS [ZUR STRUKTUR AERODYNAMISCH GESPONNENER FASERVLIESE]** c18
Lueder Gerking *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 141-153 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

The distribution of distances between fibers laid down in the same direction in aerodynamically spun nonwoven fabrics were examined. The properties of nonwovens depend largely on fiber orientation and separation. It was found that they are distributed according to an exponential law and the probability of fiber numbers in a certain length interval follows the Poisson distribution. The fibers are distributed at random. The result may also be applied to nonwovens made of stacked fibers. ESRO

**N73-33197** Karlsruhe Univ. (West Germany). Inst. fuer Stroemungslehre und Stroemungsmaschinen.
**VISCOUS NOZZLE FLOW [REIBUNGSBEHAFTETE DUESENSTROEMUNG]**
Dieter Geropp *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 154-163 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

The viscous laminar flow through Laval nozzles at high Reynolds numbers is described by a system of simple formulas. For the frictionless internal main stream they are deduced from streamline theory and, for the boundary layers, from a set of generalized similar solutions. The boundary layer was studied on a very thin circular cylinder moving axially through a Laval nozzle. Such boundary layers are of interest in thermoplastic fiber production in nozzles. ESRO

**N73-33198** Technische Univ., Berlin (West Germany). Inst. fuer Ueberschalltechnik.
**PROPOSAL FOR TRANSFORMATION OF COMPRESSIBLE LAMINAR SECOND ORDER BOUNDARY LAYER EQUATIONS [EIN VORSCHLAG ZUR TRANSFORMATION DER KOMPRESSIBLEN LAMINAREN GLEICHUNGEN DER GRENZSCHICHTTHEORIE ZWEITER ORDNUNG]**
Roger Grundmann *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 164-172 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

The unexpanded Levy-Lees integral transformation was applied to the second order boundary layer partial differential equations. In this way, the development of an approximative expression for the term d(eta)/ds is avoided. ESRO

**N73-33199** Karlsruhe Univ. (West Germany). Inst. fuer Stromungslehre und Stroemungsmaschinen.
**SHOCK PROCESSES AND NUCLEAR FUSION [STOSSPROZESSE UND ATOMKERNFUSION]**
Paul-Juergen Hahn *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 173-178 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

A method to produce thermonuclear energy from fusion reactions of mini-atomic bombs is discussed. The main problem is the ignition, and ultrashort, ultrastrong, intense, relativistic electron beams are proposed. To produce these beams, a high energy capacitor circuit can be used, as well as a capacitor in the form of a superconducting toroid. It is shown by calculation that this method is not feasible. ESRO

**N73-33200** Bochum Univ. (West Germany). Inst. fuer Thermo- und Fluiddynamik.
**MASS FLOW RATE OF LAMINAR DISSOCIATED EQUILIBRIUM BOUNDARY LAYER [UEBER DIE PRODUKTIONSDICHTE EINER LAMINAREN DISSOZIIERTEN GLEICHGEWICHTS-GRENZSCHICHT]**
Michael Jischa *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 179-194 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

The partial continuity equation was used in connection with boundary layer equations to determine the mass rate of formation of species in the equilibrium state of laminar flow. It was shown that for a flat plate boundary layer under certain assumptions the profile m sub A delta square/mu is independent of the distance from the leading edge. In this expression, m sub A is the mass rate of formation of atoms, delta is the boundary layer thickness, and mu is the viscosity. By means of an example, this equilibrium profile, as well as the equilibrium profiles of atom mass fraction and temperature, is compared with corresponding nonequilibrium profiles. Author (ESRO)

**N73-33201** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Hauptabteilung Wissenschaft und Technik.
**CORRELATION PARAMETERS FOR CO-AXIAL, HETEROGENEOUS, COMPRESSIBLE FREE JETS [KORRELATIONSPARAMETER FUER KOAXIALE, HETEROGENE, KOMPRESSIBLE FREISTRAHLEN]**
Egon Krause *In its* Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 195-209 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

Correlation parameters were derived from conservation equations, according to which the lengths of the velocity core, the temperature core, and the concentration core of free jets can be correlated for different test conditions. The length of the various cores is roughly defined by the distance between the initial cross section and the point on the center line where velocity, temperature, and concentration begin to deviate. Although the discrepancy in the experimental data was removed by the correlation parameters, additional experiments are necessary to confirm the validity of the parameters. Author (ESRO)

**N73-33202#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Hauptabteilung Wissenschaft und Technik.
**PAPERS ON FLUID DYNAMICS WITH EMPHASIS ON BOUNDARY LAYER THEORY, PART 2 [BEITRAEGE ZUR STROEMUNGSMECHANIK, INSBESONDERE ZUR GRENZSCHICHTTHEORIE, TEIL 2]**
9 Mar. 1972 215 p refs Partly in ENGLISH and partly in GERMAN; ENGLISH summaries
(DLR-FB-72-27-Pt-2) Avail: NTIS HC $12.75; DFVLR, Porz, West Ger. 46,20 DM

Several topics in the field of fluid dynamics are discussed, and applications of the boundary layer theory are emphasized. A survey is given of skin friction theories for compressible turbulent boundary layers. A closed form approximation is proposed in the dissipation integral for incompressible turbulent boundary layers. The generalized equations for transport are also discussed, assuming intermolecular interaction. For individual titles, see N73-33203 through N73-33216.

**N73-33203** Technische Univ., Berlin (West Germany). Inst. fuer Ueberschalltechnik.
**SKIN FRICTION COEFFICIENT CF IN TURBULENT COMPRESSIBLE BOUNDARY LAYERS [EINIGE BEMERKUNGEN ZU DEM GESETZ FUER DEN WANDREIBUNGSKOEFFIZIENT CF IN TURBULENTEN KOMPRESSIBLEN GRENZSCHICHTEN]**
H. Kuester, W. Neubert, and W. Haase *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 217-233 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

A survey of skin friction theories for compressible turbulent boundary layers is given, and a comparison of two theories is made with measurements. For the incompressible boundary layer theory, three well known theories are compared with recent measurements at extremely low Reynolds numbers. ESRO

**N73-33204** Technische Univ., Berlin (West Germany). Inst. fuer Ueberschalltechnik.
**DISSIPATION LAW OF INCOMPRESSIBLE TURBULENT BOUNDARY LAYERS [EIN BEITRAG ZUM DISSIPATIONSGESETZ INKOMPRESSIBLER TURBULENTER GRENZSCHICHTEN]**
H. Kuester, W. Neubert, and N. Peters *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 234-240 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

A closed form approximation is proposed for the empirical relationship I' = f(I,pi) which, following Felsch, represents the deviation from the equilibrium state, i.e. the history effect, in the dissipation integral for incompressible turbulent boundary layers. ESRO

**N73-33205** Bochum Univ. (West Germany). Inst. fuer Thermo- und Fluiddynamik.
**GENERALIZED EQUATIONS FOR TRANSPORT COEFFICIENTS ASSUMING CONFORMITY OF INTRAMOLECULAR INTERACTION POTENTIALS [VERALLGEMEINERTE BEZIEHUNGEN FUER TRANSPORTKOEFFIZIENTEN AUS ANNAHMEN UEBER DIE KONFORMITAET INTERMOLEKULARER WECHSELWIRKUNGSPOTENTIALE]**
Klaus Lucas *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 241-258 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

It is shown that most of the well known generalized equations for transport coefficients can be reduced to a common basis in molecular theory. The properties of these correlations are discussed. For the viscosity and thermal conductivity of dilute gases, experimental values are compared which clarifies the region of validity and the fundamental limitation of such relations.
Author (ESRO)

**N73-33206** Naval Ship Research and Development Center, Washington, D.C.
**VORTEX GENERATION AND PROPAGATION UNDER PERFECT SLIP-FLOW CONDITIONS [ENTSTEHUNG UND AUSBREITUNG VON WIRBELN UNTER DER PERFECT-SLIP BEDINGUNG]**
Hans J. Lugt *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 259-269 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

Renewed interest in slip flow within the realm of continuum physics has resulted in a numerical study on generation and propagation of vorticity in a flow past thin elliptic cylinders under the perfect slip condition. Computer results show that surface vorticity is more concentrated at the edges for perfect slip than for nonslip, due to the surface curvature. Flow separation, instability, and vortex shedding occur also under the perfect slip condition. Although drag is drastically reduced for slender body configurations, drag coefficients for a plate normal to the flow are almost the same for nonslip and perfect slip, at least for Reynolds number 10. All computations were carried out for Reynolds numbers below 200. Author (ESRO)

**N73-33207** Illinois Inst. of Tech., Chicago.
**AN APPROACH TO FLOW ENGINEERING VIA FUNCTIONAL FLOW MODULES**
Mark V. Morkovin *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 270-301 refs (For availability see N73-33202 24-12)
(Contract F44620-69-C-0022)

A modular approach is proposed for the case of flows around three dimensional obstacles in boundary layers and for the case of tailoring of free stream flow and turbulence by flow inserts (screens, perforated plates, honeycombs, and foam slabs). The progress in visualization techniques and the off-the-shelf availability of reliable hot-wire anemometry facilitates modern flow diagnostics for development and design. The combined usage of these and other techniques makes possible a systematic modular approach in flow engineering. ESRO

**N73-33208** Technische Univ., Berlin (West Germany). Inst. fuer Ueberschalltechnik.
**PRESSURE EFFECTS ON DYNAMIC VISCOSITY OF HELIUM IN TEMPERATURE RANGE 0.4 TO 400 K [DIE DYNAMISCHE VISKOSITAET VON HELIUM FUER TEMPERATUREN VON 0.4 - 400 K UND IHRE DRUCKABHAENGIGKEIT]**
Wolfgang Neubert *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 302-311 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

An equation was developed for the dynamic viscosity of helium for the temperature range from 0.4 to 400 K, and the results of pressure effects were investigated. The equation allows calculating the dynamic viscosity for temperature-pressure ratios, corresponding with a rarefied gas, with an average accuracy of 0.8%. Correction procedures are proposed for the dense gas range, but correction in the rarefied gas range is found to be difficult. ESRO

**N73-33209** Technische Univ., Berlin (West Germany). Inst. fuer Ueberschalltechnik.
**INVESTIGATION ON STABILITY OF HETEROGENEOUS CHEMICAL REACTIONS OF FREE RADICALS IN BOUNDARY LAYER FLOW USING INTEGRAL CONDITIONS [UNTERSUCHUNGEN UEBER DIE STABILITAET HETEROGENER CHEMISCHER REAKTIONEN VON FREIEN RADIKALEN IN GRENZSCHICHTEN MIT HILFE VON INTEGRALBEDINGUNGEN]**
Norbert Peters *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 312-330 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

The condition for stabilty of heterogeneous radical recombination in a boundary layer flow past a heat-conducting wall is formulated as an algebraic inequality between dimensionless parameters. The derivation presumes the existence of half-similar solutions of the boundary layer equations and the heat conduction equation in the wall and employs integral relations for the time dependent behavior of heat flux, temperature, and radical concentration at the phase limit between the wall and the boundary layer. The linearization of the resulting system of ordinary differential equations leads to a single relation for the stability of the steady state solution to small disturbances. ESRO

**N73-33210** Technische Univ., Berlin (West Germany). Inst. fuer Mess- und Regelungstechnik.
**PROPOSAL FOR AN AUTOMATIC EXPERIMENTER [VORSCHLAG FUER EINEN AUTOMATISCHEN EXPERIMENTATOR]** c34
Ingo Rechenberg *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 331-345 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

The practicability of mechanizing certain types of human experimental activity is discussed. This would save the experimenter time-consuming false moves in his activity, and the end result of such a development would be to leave the solution of experimental problems to automatic experimenting machines.
ESRO

**N73-33211** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Aerodynamik.
**COMPUTATION OF KINETIC FLUCTUATION ENERGY OF TURBULENT SHEAR FLOW [BERECHNUNG DER KINETISCHEN SCHWANKUNGSENERGIE TURBULENTER SCHERSTROEMUNGEN]**
Julius C. Rotta *In its* Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 347-362 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

The computation of kinetic fluctuation energy from the given distribution of mean velocity is treated. In addition to the equation

for kinetic energy, Prandtl's eddy viscosity relation is used. Three examples are given and the results discussed. There is the possibility of replacing Prandtl's eddy viscosity relation with the transport equation for the Reynolds shear stress. Author (ESRO)

**N73-33212** Technische Hochschule, Aachen (West Germany). Lehrstuhl fuer Allgemeine Mechanik.

**BOUNDARY LAYER STABILITY AT LONGITUDINALLY CURVED WALLS [GRENZSCHICHTSTABILITAET AN LONGITUDINAL GEKRUEMMTEN WAENDEN]**

Fritz Schultz-Grunow *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 363-370 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

The stability theory for small perturbations of laminar boundary layer flow along longitudinally curved walls yields the unsatisfactory result that the flow is most sensitive to perturbations when no perturbations exist. This is the result of inadmissible simplifications. An exact theory for small perturbations is given which removes the discrepancy. Author (ESRO)

**N73-33213** Technischen Universitaet, Munich (West Germany). Inst. fuer Stroemungsmechanik.

**INTEGRAL RELATIONS OF BOUNDARY LAYER THEORY [DIE INTEGRALBEZIEHUNGEN DER GRENZSCHICHTTHEORIE]**

E. Truckenbrodt *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 371-390 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

The integral relations for the velocity and thermal boundary layer are presented in tabular form, for the purpose of approximation in boundary layer theory. ESRO

**N73-33214** Hamburg Univ. (West Germany). Inst. fuer Schiffbau.

**THE BOUNDARY LAYER ALONG A SHIP [ZUR GRENZSCHICHT AM SCHIFF]**

K. Wieghardt *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 391-397 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

The boundary layer along a ship was investigated. It was found by wind tunnel tests of a double model that the boundary layer is rather thick near the keel as a result of cross flow directed downwards at the foreship. A single test on a ship is mentioned, as well as a description of three dimensional boundary layers by tensor calculus. ESRO

**N73-33215** Technische Univ., Berlin (West Germany). Lehrstuhl fuer Ueberschalltechnik.

**CENTRIFUGAL LAMINAR FLOW [DIE LAMINARE STROEMUNG IN EINER ZENTRIFUGE]**

H.-J. Wirz *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 398-415 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

The three dimensional, incompressible, fluid flow inside a torus was investigated theoretically. Starting with the Navier-Stokes equations, the main flow and the secondary flow was calculated under the assumption of small Ekman numbers. The parameters considered were the Ekman number and the ratio of radius of the torus to the radius of the shaft. Author (ESRO)

**N73-33216** Karlsruhe Univ. (West Germany). Inst. fuer Stroemungslehre und Stroemungs-Maschinen.

**LAVAL NOZZLE FLOW WITH SEVERAL CONTRACTIONS [DIE STROEMUNG IN DER LAVALDUESE MIT MEHREREN EINSCHNUERUNGEN]**

Juergen Zierep *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 416-423 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

The different possible fluid flows in a supersonic channel with several contractions are discussed, using the field of directions of the stream-tube theory differential equation. The relation between the solutions obtained and the flow through a Laval nozzle with heat addition (especially with condensation) was established. ESRO

**N73-33217#** Sandia Labs., Albuquerque, N.Mex. Theoretical and Fluid Dynamics Div.

**THREE-DIMENSIONAL, INCOMPRESSIBLE BOUNDARY LAYER ON BLUNT BODIES. PART 1: ANALYSIS AND RESULTS**

F. G. Blottner and Molly Ellis Apr. 1973 99 p refs Sponsored by AEC

(SLA-73-366-Pt-1) Avail: NTIS HC $7.00

The governing equations for laminar flow in terms of an orthogonal surface coordinate system on blunt bodies are solved numerically. The coordinate system is determined by the intersection with the body surface of meridional planes which pass through an axis containing the stagnation point. The other coordinate is obtained numerically from the orthogonality condition. The inviscid flow is obtained from the potential flow for triaxial ellipsoids and elliptic paraboloids at incidence. The governing equations are transformed with new independent and dependent variables of the Goertler type. The particulars of the finite-difference solutions of these equations with Crank-Nicolson and Krause schemes are presented. Author (NSA)

**N73-33218#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.

**INTERACTION BETWEEN A FLOW AND A VIBRATING BODY Ph.D. Thesis - Tech. Univ. Berlin**

Richard Landl 2 Feb. 1973 68 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-42) Avail: NTIS HC $5.50; DFVLR, Porz, West Ger. 22,30 DM

The different kinds of interactions between a flow and a mechanical oscillator are described. A dimensional analysis of the problem is presented which yields the governing parameters. Two kinds of interaction are treated. The first is a thin steel wire standing within a flow. The periodic wake produced by the wire causes an excitation of an oscillation. For this mechanism, a simple mathematical model is given. In the second case, a cylindrical body performs externally excited oscillations. A superposition of a flow perpendicular to the vibration plane changes the amplitude. With a graphical procedure, a qualitative description of the results is possible. Author (ESRO)

**N73-33219#** Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

**PLANE TURBULENT JET FLOW IN A FAVOURABLE PRESSURE GRADIENT**

M. J. Riley London Aeron. Res. Council 1973 26 p refs Supersedes RAE-TR-71047; ARC-33086

(ARC-CP-1236; RAE-TR-71047; ARC-33086) Avail: NTIS HC $3.50; HMSO 45p; PHI $1.95

An experimental study was made of an incompressible turbulent plane jet exhausting downstream into an external flow having a favorable longitudinal pressure gradient approximating that of two dimensional sink flow. Four flows were studied, for which the ratios of mainstream and jet velocities at the exit plane of the jet were in the range from 0.1 to 0.5. For each case, velocity profiles were measured at four streamwise stations and a traverse was made along the jet center line. The mean velocity profiles were shown to have the same shape as previously reported profiles for jets in a uniform stream. The streamwise development of the width of the jet and the velocity on its center line are presented nondimensionally and values of the lateral shear stress gradient are evaluated on the jet center line to give some indication of the development of the turbulence structure. Author (ESRO)

**N73-33220#** Queen Mary Coll., London (England).

**MEASUREMENTS OF TEMPERATURE AND PRESSURE BEHIND THE INCIDENT AND REFLECTED SHOCKS IN A SHOCK TUBE**

Michael J. Lewis and Leonard Bernstein Aeron. Res. Council 1973 48 p refs Supersedes ARC-33776

(ARC-CP-1239; ARC-33776) Avail: NTIS HC $4.50; HMSO 80p; PHI $3.35

Pressure and temperature measurements behind the incident

shock and in the reflected shock region are presented for the QMC 38.1 mm square channel shock tube using hydrogen driving shocks into nitrogen. Some temperature measurements were also made at the entrance to a convergent-divergent nozzle. The incident shock Mach number range is between 3.5 and 7. These measurements indicate that temperature gradients are present in the shocked gas and that the high temperature duration of the shocked gas is less than the steady pressure duration and is very much smaller than that predicted using ideal gas wave theory. Author (ESRO)

**N73-33221#** Queen Mary Coll., London (England).
**ON THE CALIBRATION OF PRESSURE TRANSDUCERS FOR USE IN SHOCK-TUNNELS**
R. O. Goodchild and Leonard Bernstein Aeron. Res. Council 1973 46 p refs Supersedes ARC-33832
(ARC-CP-1240; ARC-33832) Avail: NTIS HC $4.50; HMSO 75p; PHI $3.15

The calibration of high sensitivity, fast response pressure transducers is discussed, particular attention being given to those factors which can lead to significant calibration errors. It is shown that static and dynamic calibrations of piezoelectric transducers are consistent, contrary to the experience of some earlier investigators, so that where static calibration is possible, that is sufficient. In cases where static calibration is not possible, the semi-dynamic technique using a quick-acting valve is both more convenient and potentially more accurate than the shock tube technique, especially when digital recording can be employed. Author (ESRO)

**N73-33222#** Politecnico di Torino (Italy). Ist. di Macchine e Motori per Aeromobili.
**LOSS OF PRESSURE AT THE INTERFACE BETWEEN TWO RECTILINEAR DUCTS [PERDITE DI CARICO IN GIUNZIONI DI DUE CONDOTTI RETTILINEI]**
Andrea Dadone Oct. 1972 54 p refs In ITALIAN; ENGLISH summary
(Contract CNR-115.4075.69.01220)
(Publ-133) Avail: NTIS HC $4.75

Results of tests on air flow through three different junctions of two rectilinear ducts are given, all the possible flow configurations being covered. Junctions with branch angles of 30, 60 and 90 degrees are examined in compressible steady flow conditions. The Reynolds' number of the main flow ranges from 100,000 to 500,000. Empirical parabolic curves which allow correlation of the experimental results are also reported. Such experimental results are compared, as far as possible, with published results and with the theoretical methods reported in the literature; there is considerable divergence between existing data, and no theoretical model agrees satisfactorily with the experimental results. In conclusion, present tests are to be considered reliable, and the correlation curves can be used to evaluate pressure loss coefficients of junctions with sharp corners with an accuracy of about 10% of one velocity head of the combined streams, if the Reynold's number of the main flow is of the order of one hundred thousand. Author (ESRO)

**N73-33223#** Politecnico di Torino (Italy). Ist. di Macchine e Mortori per Automobili.
**SHOCK WAVE PROPAGATION AT THE INTERFACE BETWEEN TWO RECTILINEAR DUCTS [PROPAGAZIONE DI ONDE DI PRESSIONE IN GIUNZIONI DI DUE CONDOTTI RETTILINEI]**
Andrea Dadone and Antonio Ramirez Mar. 1973 21 p refs In ITALIAN
(Contract CNR-115.4075.69.01220)
(Publ-137) Avail: NTIS HC $3.25

Experimental tests on functions between a main rectilinear duct and a lateral derivation of same cross section were performed. The main duct bears a stationary flow whereas the derivation carries a pressure pulse. The angles between the ducts were between 30 to 150 degrees in steps of 30 degrees. A mathematical model was developed based on the following hypotheses: pressure losses induced by the pressure pulse on the quasi-stationary flow are essentially equal to those measured in permanent regime; the function dimensions may be ignored. A comparison between theory and experimental results shows that the first hypothesis is acceptable while the second represents at best a first order approximation. This is due to transient phenomena related to the shock wave propagation within the junction and its interaction with junction walls. Improvement of the second hypothesis requires multidimensional analysis on shock wave propagation within the function. ESRO

**N73-33224#** Naval Research Lab., Washington, D.C.
**INTERNAL WAVE GENERATION CAUSED BY THE GROWTH AND COLLAPSE OF A MIXED REGION Final Report**
J. M. Bergin 29 Jun. 1973 35 p refs
(NRL Proj. G01-06)
(AD-764050; NRL-7568) Avail: NTIS CSCL 20/4

A mathematical model is formulated for the mean disturbance created in a linearly stratified fluid by the growth and collapse of a localized region of turbulent, mixed fluid. Linearized differential equations for the disturbance are obtained from the Navier-Stokes equations under the Boussinesq approximation after various intuitive and empirical considerations. The divergence of the mean turbulent density flux enters these equations as the sole forcing function for the disturbance. The original expression for the forcing function is replaced by an appriximation to simplify numerical evaluation of the disturbance. A solution is obtained for the disturbance in a fluid of constant depth and compared with measured data. Specific proposals are made for correcting the deficiences of the model at small distances from the mixed region. (Modified author abstract) GRA

**N73-33225#** Naval Research Lab., Washington, D.C. Plasma Dynamics Branch.
**A CONSERVATIVE SECOND ORDER ACCURATE FLUID ALGORITHM FOR VARIABLE SPATIAL GRID Interim Report on a continuing problem**
David V. Anderson Jul. 1973 23 p refs
(AD-765316; NRL-MR-2612) Avail: NTIS CSCL 20/4

The widely used Lax-Wendroff two-step algorithm for solving fluid equations is well known to be conservative and second order accurate on a constant spatial grid. But on a variable grid the accuracy is reduced to first order although the conservative property remains. A modification of this method is introduced which is both conservative and second order accurate on the variable grid. This method works well with all of the fluid equations but the author examines the simplest case and studies the continuity equation with a constant velocity field. For a given Fourier mode the amplitude and phase errors are obtained in the three dimensional parameter space of wavelength, fluid speed, and grid spacing ratio. A test problem is run with each of the algorithms and the errors are followed as a function of time. All of the results confirm our expectation that the modified algorithm is significantly more accurate in regions where the grid is variable and indeed is second order accurate there. Author (GRA)

**N73-33226#** Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
**SOLUTION OF THE TIME-DEPENDENT NAVIER-STOKES EQUATION WITH A PERIODIC BOUNDARY CONDITION**
Louis W. Ehrlich Jul. 1973 30 p refs Sponsored in part by Natl. Heart and Lung Inst.
(Contract N00017-72-C-4401)
(AD-764582; APL-TG-1219) Avail: NTIS CSCL 20/4

The unsteady Navier-Stokes equation for two-dimensional viscous incompressible flow in a box is solved by a finite difference marching technique. The upper surfaces of the box are assumed to be in contact with a plate oscillating in time. Although the finite difference marching technique is not new, its application appears to be. Author (GRA)

**N73-33227#** Denver Research Inst., Colo. Div. of Mathematical Sciences.
**AN ANALYSIS OF SCALING FOR LINEAR INVISCID INTERNAL WAVES Final Report**
N. Bleistein and J. K. Cohen 24 Jul. 1973 23 p refs
(Contract N00014-67-A-0394-0005; NR Proj. 041-434)
(AD-764579; MS-R-7401) Avail: NTIS CSCL 20/4

A consistent scaling is developed for the study of linear inviscid internal waves in the ocean, the atmosphere or experimental tanks. There are scales to characterize the linearization, the slow variation of the amplitude, the stratification

scale, modal versus nonmodal flow and transverse variation of the ambient density and pressure. Observations in the ocean, the atmosphere and tank experiments are cited both for motivation and corroboration. Author (GRA)

**N73-33228#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**THE WEAR OF BLADE HYDRAULIC MACHINES FROM CAVITATION AND DEPOSITS**
V. Ya. Karelin 3 Mar. 1973 137 p refs Transl. into ENGLISH from the monograph "Iznos Lopastnykh Gidravlicheskikh Mashin ot Kavitatsii i Nanosov" USSR, 1970 p 1-182
(AF Proj. 7343)
(AD-758322; FTD-HC-23-996-72) Avail: NTIS CSCL 13/7
The forms and character of wear of hydraulic turbines, axial and centrifugal pumps due to abrasion by suspended accretions and cavitation are analyzed. The conditions in which cavitation arises and the mechanism of cavitation erosion are examined. A theory of interaction between deposits and working surfaces of hydraulic machines is presented. A complex of measures is given to protect hydraulic machines from cavitation erosion and suspended deposits. (Author Modified Abstract). (GRA)

**N73-33229#** Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group.
**PRESSURE DROP IN AIR FLOW ACROSS BANKS OF FIN-TUBES WITH VARYING PITCH**
L. Sherman Mar. 1973 28 p refs
(PB-220315/6; CSIR-SR-CENG-003) Avail: NTIS HC $3.00 CSCL 13A
Air was blown isothermally across a bank of helically wound L-type fin tubes containing 6 tube rows. Six banks, each with a different triangular tube pitch, were investigated. The generally accepted Robinson and Briggs correlation underestimated the measured friction factor by about 20%. This is attributed to insufficient recognition of the effect of fin tube dimensions in this correlation, which also underestimates the effect of pitch, at least for the tubes used in these experiments. GRA

**N73-33230#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**EFFECT OF INLET CONDITIONS ON THE OPTIMAL SHAPE OF A DIFFUSER**
D. I. Morozov 6 Aug. 1973 14 p refs Transl. into ENGLISH from Energ. Mashinostr. (USSR), no. 11, 1971 p 61-65
(AD-765577; FTD-HT-23-841-73) Avail: NTIS CSCL 20/4
The research is based on the application to short diffusers of the approximation theory of potential flow of a fluid in channels and the Bur single-parameter theory of a turbulent boundary layer. GRA

# 13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and gebdesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

**N73-33231** Illinois Univ., Urbana.
**AN INVESTIGATION OF HF AURORAL BACKSCATTER OVER A BISTATIC PATH Ph.D. Thesis**
Frederick Otto Fahlsing 1972 129 p
Avail: Univ. Microfilms Order No. 73-17201
A Wullenweber antenna array was used to record stepped-frequency ionograms over a bistatic path including an auroral reflection. Energy was transmitted northward from Rome, New York. Ionograms were recorded near Urbana, Illinois, at stepped-azimuth intervals over a northerly sector. The ionograms were analyzed to determine the statistical occurrence of auroral backscatter as a function of azimuth and time delay. These data were compared with theoretical results based upon a specular reflection from an auroral curtain. A technique was developed to locate the reflection point from the time delay, azimuth and maximum frequency of a stepped-frequency auroral backscatter trace. Maps were constructed showing regions of maximum frequency of occurrence of HF auroral backscatter. Results show an equatorward shift of the backscatter region with increasing magnetic activity and suggest that reflecting surfaces are horizontally elongated along lines of constant magnetic inclination. Dissert. Abstr.

**N73-33232** Ohio State Univ., Columbus.
**COMPUTATION TECHNIQUES FOR VARIOUS GRAVITY ANOMALY CORRECTION TERMS AND THEIR EFFECT UPON DEFLECTION OF THE VERTICAL COMPUTATIONS FOR MOUNTAINOUS DATA Ph.D. Thesis**
Harry William Emrick 1973 158 p
Avail: Univ. Microfilms Order No. 73-18889
The introductory background section is concerned with the discussion of terminology, concepts, discoveries and events lending to an understanding of the classical and modern theories of gravimetric geodesy. The various correction terms to the gravity anomaly and some alternative computational procedures are discussed. The recommended computational procedures are an iterative solution (Bjerhammer and Moritz) and a nonlinear solution (Moritz). A 6 degree by 6 degree anomaly field, which is representative of a mountainous area, is established using available gravity and elevation data and Rapp's prediction program. The deflection of the vertical computation procedures are discussed and a recommended approach is given using a modified Fischer technique. The results upon which the conclusions are drawn are illustrated with several tables and figures. Also included in an appendix are brief derivations, illustrations of the data fields, and some suggestions for the computor.
Dissert. Abstr.

**N73-33233** New York Univ., N.Y. School of Engineering and Science.
**THE OPTIMUM USE OF INFRARED DATA AS OBTAINED FROM METEOROLOGICAL AND OCEANOGRAPHIC APPLICATIONS Ph.D. Thesis**
Ming-Dah Chow 1973 106 p
Avail: Univ. Microfilms Order No. 73-19382
Methods are developed for determining sea surface temperatures, temperature soundings, and humidity soundings from infrared data as obtained from satellites. Temperature soundings are corrected directly according to the ratio of the measured and calculated radiances, while humidity soundings are corrected inversely according to the ratio of these radiances. In addition, ratios of measured and calculated radiances are amplified by small gain factors to reduce the computing time. The solutions are very stable with respect to errors introduced in the measured radiances. The effect of random errors are reduced by a weighted average. An iterative scheme for determining successively the sea surface temperature, temperature sounding, humidity sounding, and then back to the sea surface temperature, and so on, is also discussed. By using the inverted temperatures and humidities, the geopotential heights at ten pressure levels, the infrared losses from the sea surface, and the cooling rates in the atmosphere are also calculated. The results are very close to those calculated from the observed temperatures and humidities. Dissert. Abstr.

**N73-33234** Minnesota Univ., Minneapolis.
**ADSORBENT COLUMNS AS SAMPLERS FOR ORGANIC VAPORS IN THE ATMOSPHERE Ph.D. Thesis**
Perry Bert Lonnes 1973 210 p
Avail: Univ. Microfilms Order No. 73-18130
The potential of several new materials for sampling and concentrating organic vapors in the atmosphere was studied. The substrates studied were Porapak N, P, Q, R, S; chromosorb 101, 102, 103; and Durapak n-Octane/Poracil C. The parameters governing the design of adsorbent columns for sampling organic vapors from the atmosphere were also investigated. A general method for calculating the amount of adsorbent required for a given sampling application is proposed. The method allows estimation of sampling volumes and thermal elution volumes for a given adsorbate/adsorbent pair. Temperature dependence curves of the specific retention volumes of the n-paraffins on Porapak R and Chromosorb 102 are presented together with nonlinear regression equations relating specific retention volume and Kovats retention indices. The importance of axial diffusion and flow rate is also shown. Dissert. Abstr.

**N73-33235** Texas Univ., Austin.
**TWO-DIMENSIONAL TIME-DEPENDENT NUMERICAL SIMULATION OF ATMOSPHERIC FLOW OVER AN URBAN AREA Ph.D. Thesis**
Tsann-wang Yu 1972 125 p
Avail: Univ. Microfilms Order No. 73-18517

A two-dimensional, time-dependent earth-atmosphere numerical model based on the conservation laws of hydrodynamics was formulated and used to investigate various urban heat island phenomena. The numerical method employs upstream finite differencing on the advective terms. Time stepping is accomplished with a backward implicit scheme. The model predicts that, under conditions of temperature inversion upwind of a city, a major portion of the urban heat island can be produced by the increased surface roughness in the urban area. Numerical experiments conducted with various stable temperature stratifications show a linear relationship between urban heat island intensity and the rural temperature inversion with the heat island increasing in intensity as the upwind inversion becomes stronger.
Dissert. Abstr.

**N73-33236** Illinois Univ., Urbana.
**A STUDY OF NONLINEAR ATMOSPHERIC WAVES Ph.D. Thesis**
Han-Ru Cho 1972 90 p
Avail: Univ. Microfilms Order No. 73-17153

Criteria are established to distinguish between weak and strong nonlinear effects. Various weak and strong nonlinear phenomena are classified. In particular, the resonant wave-wave interaction of acoustic-gravity waves, the nonlinear dispersive effects on the propagation of gravity waves, and the possibility of long waves in the upper atmosphere are treated. Some aspects of the strong nonlinear phenomena are also discussed.
Dissert. Abstr.

**N73-33237** Ohio State Univ., Columbus.
**APPLICATION OF KINEMATICAL GEODESY FOR DETERMINING THE SHORT WAVE LENGTH COMPONENTS OF THE GRAVITY FIELD BY SATELLITE GRADIOMETRY Ph.D. Thesis**
George Bruce Reed 1973 173 p
Avail: Univ. Microfilms Order No. 73-18944

Satellite-borne hybrid measuring systems which, in general, provide a capability to sense some spectrum of the earth's gravitational field directly are being developed. Among each such systems currently in an advanced stage of development are satellite gradiometers. A geodesy oriented investigation was carried out to develop a possible procedure for the use of satellite gradient measurements in obtaining gravity boundary values and to determine if gradiometry can provide, with sufficient accuracy, discrete geopotential information equivalent to harmonic degree 90.
Dissert. Abstr.

**N73-33238** Ohio State Univ., Columbus.
**THE METRIC CARTOGRAPHIC POTENTIAL OF GEOSTATIONARY/GEOSYNCHRONOUS SATELLITES Ph.D. Thesis**
Louis Henry Knipling 1973 273 p
Avail: Univ. Microfilms Order No. 73-18916

The metric cartographic potential of a satellite camera orbiting at 35,786 km about the earth was investigated. Major pertinent areas contributing to the determination of this potential were investigated and reported upon. These areas include: the geosynchronous orbit, design requirements of a suitable telescopic space camera, the effects of geophysical phenomena upon the imagery, the imagery sensors, the electronic transmission link, and the accuracy requirements for maps. A photogrammetric data generator based upon the use of highly convergent photography was used to develop 20 cases in which the focal lengths were 15 and 45 meters. It is concluded that the 15 meter focal length system has the capability of acquiring photography to support Class A mapping at a scale of 1:800,000 when no ground control is available and Class A mapping at a scale of 1:35,000 when ground control of 1 meter accuracy is present. The 45 meter camera can support mapping of 1:350,000 Class A when no ground control is present and Class A mapping of scale 1:35,000 when ground control of 1 meter accuracy is introduced into the solution.
Dissert. Abstr.

**N73-33239** Illinois Univ., Urbana.
**INVESTIGATION OF THE IONSPHERIC RESPONSE TO THE SOLAR ECLIPSE OF 7 MARCH 1970 BY THE THOMSON SCATTER RADAR TECHNIQUE AT THE MILLSTONE HILL IONOSPHERIC OBSERVATORY Ph.D. Thesis**
William Ledyard Oliver 1973 180 p
Avail: Univ. Microfilms Order No. 73-17610

The Thomson-scatter radar data obtained at the Millstone Hill Ionospheric Observatory on the day of the solar eclipse of 7 March 1970 are reported and analyzed. Values of electron density, electron and ion temperature, and ion composition are obtained throughout the eclipse. The ionospheric response to the eclipse is analyzed in terms of ion chemical processes and in terms of the distribution of solar radiations emanating from the solar atmosphere. Residual ionospheric densities observed at eclipse maximum phase are interpreted in terms of solar coronal emissions and the differential abscrption of solar emissions in the ionosphere. The observed ion composition is used to derive values of important ion-neutral reaction rate coefficients. The temperature data are interpreted in terms of the ionospheric response to the large magnetic storm in progress during the eclipse. Independent ion-composition data obtained by rocket at Wallops Island during the eclipse are used to determine nitric oxide concentrations.
Dissert. Abstr.

**N73-33240** Illinois Univ., Urbana.
**INTERPRETATION OF AEROMAGNETIC OR GRAVITY DATA BY THE METHOD OF DIFFERENCE MAPPING Ph.D. Thesis**
Fu-Shyong Ju 1973 200 p
Avail: Univ. Microfilms Order No. 73-17574

An attempt is made to investigate the potential differences between various levels in a Newtonian potential field, to interpret the physical significance of such differences and to explore the possibility of using a difference mapping technique in mineral exploration. Difference fields in consecutive order are obtained from the continuation of a potential field which is known at a certain level. This part of the problem is basically equivalent to solving the Laplace equation subject to a plane boundary condition. To interpret the source of a potential field, in geophysics, it is essential to separate effects of regional and local origin. The method of upward continuation of the potential may be used to eliminate local irregularities of a given gravity or magnetic anomaly field and thus separate the effects due to far and near sources.
Dissert. Abstr.

**N73-33241** Catholic Univ. of America, Washington, D.C.
**VERTICAL DISTRIBUTION OF VIBRATIONAL ENERGY OF MOLECULAR NITROGEN IN A STABLE AURORAL RED ARC AND ITS EFFECT ON IONOSPHERIC ELECTRON DENSITIES Ph.D. Thesis**
George Peyton Newton 1973 160 p
Avail: Univ. Microfilms Order No. 73-19022

Previous solutions of the problem of the distribution of vibrationally excited molecular nitrogen in the thermosphere have either assumed a Boltzmann distribution and considered diffusion as one of the loss processes or solved for the energy level populations and neglected diffusion. This work combines both of the previous approaches by solving the time dependent continuity equations, including the diffusion process, for the first six energy levels of molecular nitrogen for conditions in the thermosphere corresponding to a stable auroral red arc. The primary source of molecular nitrogen excitation was sub-excitation, inelastic, collisions between thermal electrons and molecular nitrogen. The reaction rates for this process were calculated from published cross section calculations.
Dissert. Abstr.

**N73-33242** Saskatchewan Univ., Saskatoon.
**THE ROLE OF ELECTRICAL PROCESSES IN THE THUNDERSTORM OF THE CANADIAN PRAIRIES Ph.D. Thesis**
James Edwin Pakiam 1972 257 p
Avail: Univ. Microfilms Order No. 73-18670

The distribution of thunderstorms over the Canadian prairies was studied by performing a Fourier analysis on hourly thunderstorm reports accumulated over a ten year period. The results of the analysis, added to information from earlier works. Measurements of the electric fields beneath storms were conducted during the summers of 1967 to 1970. Electrostatic

voltmeters (field mills) were constructed and used in Alberta both in fixed station operation and in mobile operation. Aided with information from radar, hailfall and rainfall, case studies of three storms were performed. The analysis of the results suggested that the dynamical features of storms play a more important part than the microphysical ones in affecting the electrical behaviour of storms, once the conditions necessary for the charging mechanism to function (adequate thermodynamic instability and moisture leading to a minimum value of updraft speed in convective clouds and subsequent penetration of some critical cloud temperature or height in the atmosphere) are satisfied.

Dissert. Abstr.

**N73-33243*#** Kansas Univ. Center for Research, Inc., Lawrence.

**DETECTION OF A LOW PRESSURE CENTER FROM ERTS IMAGERY**

Stanley Morain, Principal Investigator and Donald L. Williams 9 May 1973 2 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21822)

(E73-10978; NASA-CR-133757; CRINC-DIIR-2246-6) Avail: NTIS HC $3.00 CSCL 04B

There are no author-identified significant results in this report.

**N73-33244*#** Nuclear Research Center, Athens (Greece).

**APPLICATION OF ERTS-1 IMAGERY TO LAND USE, FOREST DENSITY AND SOIL INVESTIGATIONS Progress Report, Dec. 1972 - Jul. 1973**

Nicholas J. Yassoglou, Principal Investigator 25 Aug. 1973 37 p Sponsored by NASA ERTS

(E73-10988; NASA-CR-133767) Avail: NTIS HC $4.00 CSCL 02F

The author has identified the following significant results. Photographic and digital imagery obtained by ERTS-1 was analyzed and assigned to land features related to agricultural and forest resources. Land use and forest site evaluation maps were prepared by comparing remote sensing and ground truth data. Relationships found in this investigation between spectral signatures recorded by ERTS-1 and land features can be used for the assessment and development of agricultural and forest resources. The results are applicable to areas with ecological and geological conditions similar to those of Greece.

**N73-33245*#** Bureau of Reclamation, Denver, Colo.

**MONITOR WEATHER CONDITIONS FOR CLOUD SEEDING CONTROL Progress Report 1 Jul. - 30 Aug. 1973**

Archie M. Kahan, Principal Investigator 30 Sep. 1973 6 p ERTS

(NASA Order S-70243-AG-8)

(E73-11071; NASA-CR-135540) Avail: NTIS HC $3.00 CSCL 04B

There are no author-identified significant results in this report.

**N73-33246*#** Brevard County Planning Dept., Titusville, Fla.

**PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Progress Report, 1 Feb. - 31 Sep. 1973**

John W. Hannah, Garland L. Thomas, and Fernando Esparza, Principal Investigators 30 Sep. 1973 38 p ref ERTS

(Contract NAS5-21847)

(E73-11083; NASA-CR-135551) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

**N73-33247*#** Rockwell International Science Center, Thousand Oaks, Calif.

**IDENTIFICATION AND INTERPRETATION OF TECTONIC FEATURES FROM ERTS-A IMAGERY Progress Report, 1 Aug. - 30 Sep. 1973**

Monem Abdel-Gawad, Principal Investigator 6 Oct. 1973 4 p ref ERTS

(Contract NAS5-21767)

(E73-11084; NASA-CR-135552) Avail: NTIS HC $3.00 CSCL 08E

The author has identified the following significant results. When comparing the ERTS-1 imagery with the United States Air Force Operational Navigation Chart, mapping errors were found in Baja California and in the coastal islands off mainland Mexico. One dramatic error noted was the Isla Tortuga which is located 9 to 9.5 km to the west of its photo location. One ERTS-1 photo shows the size of the four islands, Isla San Juanito, Isla Maria Madre, Isla Maria Magdalena, and Isla Maria Cleofas, to be much smaller than the ONC map depicts them. A prominent zone of structural and physiographic lineaments extending approximately from San Fernando, Los Angeles County towards the Oxnard area in Ventura County in an east-north-east trend were observed. In Ventura County several previously unknown faults within this zone were identified and their traces, plotted on large scale maps and 1:60,000 aerial photographs. This important fault zone is significant because it trends parallel to and partly coincides with a recent belt of seismicity related to the San Fernando 1971 earthquake.

**N73-33248*#** Alaska Univ., Fairbanks. Inst. of Water Resources.

**BREAK-UP CHARACTERISTICS OF CHENA RIVER BASIN Bimonthly Progress Report**

Robert F. Carlson, Principal Investigator 31 Sep. 1973 5 p ERTS

(Contract NAS5-21833)

(E73-11085; NASA-CR-135553; BMPR-7) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Results from snowmelt model were obtained showing the decreasing changes in snow depth for four elevational ranges in the Chena River Basin. This model is based on the energy balance of the snowpack and the results are shown on attached figures. Also, the measured hydrographs for two stations on the Chena River are shown. The next phase of the study will be to analyze the model using both ERTS-1 imagery and measured field values.

**N73-33249*#** Alaska Univ., Fairbanks.

**SURVEY OF THE SEASONAL SNOW COVER IN ALASKA Bimonthly Progress Report**

Gunter E. Weller, Principal Investigator 10 Oct. 1973 1 p ERTS

(Contract NAS5-21833)

(E73-11086; NASA-CR-135554; BMPR-7) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

**N73-33250*#** Alaska Univ., Fairbanks. Geophysical Inst.

**COORDINATION AND ESTABLISHMENT OF CENTRALIZED FACILITIES AND SERVICES FOR THE UNIVERSITY OF ALASKA ERTS SURVEY OF THE ALASKAN ENVIRONMENT Bimonthly Progress Report**

Albert E. Belon, Principal Investigator 30 Sep. 1973 11 p refs ERTS

(Contract NAS5-21833)

(E73-11088; NASA-CR-135556; BMPR-7) Avail: NTIS HC $3.00 CSCL 14B

There are no author-identified significant results in this report.

**N73-33251*#** Tennessee Univ., Knoxville. Dept. of Electrical Engineering.

**ERTS-1 IMAGERY INTERPRETATION TECHNIQUES IN THE TENNESSEE VALLEY Progress Report, 25 Mar. - 25 Sep. 1973**

Robert E. Bodenheimer, Principal Investigator Oct. 1973 10 p ERTS

(Contract NAS5-21875)

(E73-11089; NASA-CR-135557) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. Significant findings are presented which demonstrate the feasibility of delineating major terrain features, land uses, and crop species through computerized analyses. Delineation of features are presently restricted to unsurveyed areas within the same scene as the test sites. Channel 6 appears to give or contain the

most information for making feature separations of cropland, pasture, forest, and water.

**N73-33252*#** Ohio Dept. of Economic and Community Development, Columbus.
**[REGIONAL AND LOCAL LAND USE PLANNING AND MAPPING FROM SKYLAB DATA] Quarterly Progress Report, Jul. - Sep. 1973**
David C. Sweet, Principal Investigator 5 Oct. 1973 2 p EREP
(NASA Order C-21372-C)
(E73-11090; NASA-CR-135558) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

**N73-33253*#** Environmental Research Inst. of Michigan, Ann Arbor.
**SPECTRAL RATIO IMAGING METHODS FOR GEOLOGICAL REMOTE SENSING FROM AIRCRAFT AND SATELLITES**
Robert K. Vincent, Principal Investigator Oct. 1973 22 p refs Presented at the Management Utilization of Remote Sensing Data Conf., Sioux Falls, S. D., 31 Oct. 1973; sponsored by Am. Soc. of Photogrammetry Original contains imagery. Orginal photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contracts NAS5-21783; NAS9-9784; DI-BM-HO-210041)
(E73-11096; NASA-CR-135564) Avail: NTIS HC $3.25 CSCL 08G

The author has identified the following significant results. The production of ratio images from multispectral scanner data is described and several examples of ratio images from aircraft and ERTS-1 data are given for visible, reflective infrared, and thermal infrared wavelengths. The application of photogrammetric techniques to ratio images, defined for this paper as ratio scannergrammetry, is considerably aided by the lesser dependence of ratio images on atmospheric and solar illumination variations, compared with single channel scanner imagery or aerial photos. Ratio scannergrammetry is further aided by the proportionality between ratios of a target deduced from ratio images and ratios of reflectances calculated from laboratory spectra of samples from the target area. Consequently, ratios calculated from laboratory data can be used to predict which ratios are best for discriminating a given rock or mineral, to predict what other rocks or minerals will be confused with it, and finally, to place ratio scannergrammetry on an absolute basis, within an estimated standard error on the order of 5% to 10%. Examples of relative agreement between laboratory data and ratio images are given from two iron oxides, hematite and magnetite.

**N73-33254*#** Geological Survey, Washington, D.C.
**ANALYSIS STUDY OF MULTISPECTRAL DATA, ERTS-A, FROM AN AREA IN WEST PAKISTAN Progress Report, 1 Jul. - 31 Aug. 1973**
Robert G. Schmidt, Principal Investigator 25 Sep. 1973 2 p ERTS
(NASA Order S-70243-AG)
(E73-11097; NASA-CR-135566) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

**N73-33255*#** Geological Survey, Washington, D.C.
**LAND USE MAPPING AND MODELLING FOR THE PHOENIX QUADRANGLE Progress Report, 1 Jul. - 31 Aug. 1973**
John L. Place, Principal Investigator 1 Sep. 1973 4 p ERTS
(NASA Order S-70243-AG)
(E73-11098; NASA-CR-135567) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

**N73-33256*#** Geological Survey, Menlo Park, Calif.
**PRINCIPAL SOURCES AND DISPERSAL PATTERNS OF SUSPENDED PARTICULATE MATTER IN NEARSHORE SURFACE WATERS OF THE NORTHEAST PACIFIC OCEAN AND SEASONAL VARIATION IN SNOW COVER IN THE SIERRA NEVADA Progress Report, 1 Jun. - 15 Aug. 1973**
Paul R. Carlson, Principal Investigator and Deborah. R. Harden 20 Aug. 1973 14 p refs ERTS
(NASA Order S-70243-AG-7)
(E73-11099; NASA-CR-135568) Avail: NTIS HC $3.00 CSCL 08J

The author has identified the following significant results. ERTS-1 imagery used in conjunction with the surface-drift cards indicated a southerly flow direction of the central California near surface coastal currents during mid-June 1973. The near-surface currents off northern California and southern Oregon were more complex. Some drift cards were recovered north and some south of their release points; however, the prevalent direction of flow was northerly. General agreement in flow direction of coastal currents obtained from ERTS-1 imagery and drift card data reinforces the image interpretation. Complete seasonal coverage of nearshore circulation interpreted from ERTS-1 imagery will provide information necessary for proper coastal zone management. Extent of snow cover can be readily delimited on ERTS-1 band 5. In the central Sierra Nevada Mountains this past winter season, the snow line, as recorded by ERTS-1, reached an elevation of less than 1500 meters in January but had melted back to between 2500 and 3000 meters by the end of May. ERTS-1 imagery seems to provide sufficient resolution to make it a useful tool for monitoring changes in snow cover in the Sierra Nevada Mountains. Author

**N73-33257*#** Geological Survey, Denver, Colo. 08g
**THERMAL SURVEILLANCE OF ACTIVE VOLCANOES Progress Report, 1 Apr. - 30 Jun. 1973**
Jules D. Friedman, Principal Investigator 30 Jun. 1973 4 p ref ERTS
(NASA Order S-70243-AG)
(E73-11100; NASA-CR-135569) Avail: NTIS HC $3.00

The author has identified the following significant results. There are three significant scientific results of the discovery of 48 pinpoint anomalies on the upper flanks of Mt. Rainier: (1) Many of these points may actually be the location of fumarolic vapor emission or warm ground considerably below the summit crater. (2) Discovery of these small anomalies required specific V/H scanner settings for precise elevation on Mt. Rainier's flank, to avoid smearing the anomalies to the point of nonrecognition. Several past missions flown to map the thermal anomalies of the summit area did not/detect the flank anomalies. (3) This illustrates the value of the aerial IR scanner as a geophysical tool suited to specific problem-oriented missions, in contrast to its more general value in a regional or reconnaissance anomaly-mapping role.

**N73-33258*#** Kansas Univ. Center for Research, Inc., Lawrence. Atmospheric Science Lab.
**DETECTION OF MOISTURE AND MOISTURE RELATED PHENOMENA FROM SKYLAB Monthly Progress Report, Sep. 1973**
Joe R. Eagleman, Ernest C. Pogge, Richard K. Moore, Principal Investigators, Norman Hardy, Wen Lin, and Larry League Sep. 1973 3 p EREP
(Contract NAS9-13273)
(E73-11101; NASA-CR-135570) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

**N73-33259*#** Texas Technological Univ., Lubbock. Remote Sensing Lab.
**DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS Progress Report, Apr. - Sep. 1973**
C. C. Reeves, Jr., Principal Investigator 30 Sep. 1973 10 p ERTS
(Contract NAS5-21720)
(E73-11102; NASA-CR-135571) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. This project is designed to correlate ERTS-1 satellite imagery signatures with the water balance ecosystem and geology of select playa lake basins in West Texas. The principal work consisted of monitoring the weather instruments, the measurement of water levels and water depths examination of MSS imagery, and measurement of water and mud areas by use of ESIAC

(Electronic Satellite Image Analysis Console) at Stanford Research Center, Menlo Park, California. A cost/benefit analysis, comparing the use of ERTS-1 data to more conventionally secured data, revealed that use of ERTS-1 data for such a survey reduces cost from $2.00 to $0.03/square mile.

**N73-33260*#** Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
**COMPARISON OF PREPROCESSING AND CLASSIFICATION TECHNIQUES AS APPLIED TO MULTISPECTRAL SCANNER DATA Interim Report**
George J. McMurtry, Gary W. Petersen, Principal Investigators, and J. R. Hoosty May 1973 4 p ref ERTS
(Contract NAS5-23133)
(E73-11103; NASA-CR-135572; ORSER-SSEL-TR-15-73) Avail: NTIS HC $3.00 CSCL 14E
There are no author-identified significant results in this report.

**N73-33261*#** Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
**CANONICAL ANALYSIS APPLIED TO THE INTERPRETATION OF MULTISPECTRAL SCANNER DATA Interim Report**
George J. McMurtry, Gary W. Petersen, Principal Investigators, H. M. Lachowski, and F. Y. Borden May 1973 3 p ref ERTS
(Contract NAS5-23133)
(E73-11104; NASA-CR-135573; ORSER-SSEL-TR-17-73) Avail: NTIS HC $3.00 CSCL 08M
There are no author-identified significant results in this report.

**N73-33262*#** Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
**PROCESSING OF REMOTE SENSING DATA Interim Report**
George J. McMurtry, Gary W. Petersen, Principal Investigators, S. J. Chung, and N. B. Bolling May 1973 20 p refs ERTS
(Contract NAS5-23133)
(E73-11105; NASA-CR-135574; ORSER-SSEL-TR-19-73) Avail: NTIS HC $3.00 CSCL 14E
There are no author-identified significant results in this report.

**N73-33263*#** Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources (ORSER).
**DEVELOPMENT OF THE HYBRID APPROACH TO DATA PROCESSING Interim Report**
George J. McMurtry, Gary W. Petersen, Principal Investigators, H. A. Weeden, F. Y. Borden, D. N. Applegate, and N. B. Bolling May 1973 17 p ref ERTS
(Contract NAS5-23133)
(E73-11106; NASA-CR-135576; ORSER-SSEL-TR-13-73) Avail: NTIS HC $3.00 CSCL 05B
There are no author-identified significant results in this report.

**N73-33264*#** Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources (ORSER).
**MAPPING OF ANTHRACITE REFUSE Interim Report**
George J. McMurtry, Gary W. Petersen, Principal Investigators, D. N. Thompson, and F. Y. Borden May 1973 18 p refs ERTS
(Contract NAS5-23133)
(E73-11107; NASA-CR-135575; ORSER-SSEL-TR-20-73) Avail: NTIS HC $3.00 CSCL 08B
There are no author-identified significant results in this report.

**N73-33265*#** Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
**CORRECTION OF BANDING IN MSS DIGITAL DATA Interim Report**
George J. McMurtry, Gary W. Petersen, Principal Investigators, and F. Y. Borden May 1973 2 p ref ERTS
(Contract NAS5-23133)
(E73-11108; NASA-CR-135577; ORSER-SSEL-TR-22-73) Avail: NTIS HC $3.00 CSCL 05B
There are no author-identified significant results in this report.

**N73-33266*#** Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
**LAND USE MAPPING Interim Report**
George J. McMurtry, Gary W. Petersen, Principal Investigators, F. Y. Borden, H. A. Weeden, D. N. Applegate, and N. B. Bolling May 1973 10 p ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-23133)
(E73-11109; NASA-CR-135578; ORSER-SSEL-TR-14-73) Avail: NTIS HC $3.00 CSCL 08B
There are no author-identified significant results in this report.

**N73-33267*#** Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
**SURVEY AND INVENTORY OF FOREST RESOURCES Interim Report**
George J. McMurtry, Gary W. Petersen, Principal Investigators, B. J. Turner, and D. L. Williams May 1973 14 p ref ERTS
(Contract NAS5-23133)
(E73-11110; NASA-CR-135579; ORSER-SSEL-TR-16-73) Avail: NTIS HC $3.00 CSCL 02F
There are no author-identified significant results in this report.

**N73-33268*#** Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
**INVESTIGATION OF VEGETATIVE COVER CONDITIONS Interim Report**
George J. McMurtry, Gary W. Petersen, Principal Investigators, B. F. Merembeck, and F. Y. Borden May 1973 15 p ref ERTS
(Contract NAS5-23133)
(E73-11111; NASA-CR-135580; ORSER-SSEL-TR-21-73) Avail: NTIS HC $3.00 CSCL 08F
There are no author-identified significant results in this report.

**N73-33269*#** Pennsylvania State Univ., University Park. Space Science and Engineering Lab.
**ACID MINE DRAINAGE AND STRIP MINES Interim Report**
George J. McMurtry, Gary W. Petersen, Principal Investigators, S. S. Alexander, and J. L. Dein May 1973 8 p ref ERTS
(Contract NAS5-23133)
(E73-11112; NASA-CR-135581; ORSER-SSEL-TR-23-73) Avail: NTIS HC $3.00 CSCL 08I
There are no author-identified significant results in this report.

**N73-33270*#** Cornell Univ., Ithaca, N.Y. Dept. of Natural Resources.
**EVALUATION OF SATELLITE IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES (SKYLAB) Progress Report, 1-30 Sep. 1973**
Ernest E. Hardy, Principal Investigator 30 Sep. 1973 1 p EREP
(Contract NAS9-13364)
(E73-11113; NASA-CR-135582) Avail: NTIS HC $3.00 CSCL 08B
There are no author-identified significant results in this report.

**N73-33271*#** Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
**INTERDISCIPLINARY APPLICATION AND INTERPRETATION OF ERTS DATA WITHIN THE SUSQUEHANNA RIVER BASIN (RESOURCE INVENTORY, LAND USE, AND POLLUTION): PROGRAM DESCRIPTIONS Interim Report**
George J. McMurtry, Gary W. Petersen, Principal Investigators, F. Y. Borden, D. N. Applegate, B. J. Turner, H. M. Lachowski, and J. R. Hoosty May 1973 92 p refs ERTS
(Contract NAS5-23133)

(E73-11114; NASA-CR-135583; ORSER-SSEL-TR-10-73) Avail: NTIS HC $6.75 CSCL 08H

There are no author-identified significant results in this report.

**N73-33272*#** Pennsylvania State Univ., University Park. Space Science and Engineering Lab.

**CATALOGUES FOR REMOTE SENSING DIGITAL DATA TAPES Interim Report**

George J. McMurtry, Gary W. Petersen, Principal Investigators, F. Y. Borden, H. M. Lachowski, and D. N. Applegate May 1973 22 p ERTS

(Contract NAS5-23133)

(E73-11115; NASA-CR-135584; ORSER-SSEL-TR-18-73) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

**N73-33273*#** Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources (ORSER).

**STORAGE AND RETRIEVAL OF ERTS AND UNDERFLIGHT IMAGERY Interim Report**

George J. McMurtry, Gary W. Petersen, Principal Investigators, and N. B. Bolling May 1973 10 p ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-23133)

(E73-11116; NASA-CR-135585; ORSER-SSEL-TR-12-73) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

**N73-33274*#** National Ocean Survey, Rockville, Md. Photogrammetric Research Branch.

**SKYLAB A PROPOSAL AEROTRIANGULATION WITH VERY SMALL SCALE PHOTOGRAPHY Quarterly Report, 15 Jul. - 15 Oct. 1973**

Morton Keller, Principal Investigator 15 Oct. 1973 1 p EREP

(NASA Order T-4110-B)

(E73-11117; NASA-CR-135592) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

**N73-33275*#** Battelle Columbus Labs., Ohio.

**CALIBRATION AND EVALUATION OF SKYLAB ALTIMETRY FOR GEODETIC DETERMINATION OF THE GEOID Progress Report, 1-30 Sep. 1973**

A. G. Mourad and D. M. Fubara, Principal Investigators 12 Oct. 1973 24 p refs EREP

(Contract NAS9-13276)

(E73-11120; NASA-CR-135658; PR-7) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

**N73-33276*#** Nebraska Univ., Lincoln.

**PROPOSAL TO EVALUATE THE USE OF ERTS-A IMAGERY IN MAPPING AND MANAGING SOIL RANGE RESOURCES IN THE SAND HILLS REGION OF NEBRASKA Progress Report, 1 Jul. - 30 Aug. 1973**

James V. Drew, Principal Investigator 12 Oct. 1973 9 p ERTS

(E73-11121; NASA-CR-135659) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Delineation of soil associations of McPherson County was accomplished with MSS band 5 image 1025-16554 and MSS band 6 image 1170-17020. Image 1025-16554 provided delineation of associations where subirrigated meadows and cultivated fields were the predominant features. Image 1170-17020 which is winter imagery with snow cover and low sun angle delineated those associations which were significantly different in topography.

**N73-33277*#** Lund Univ. (Sweden). Dept. of Physical Geography.

**EVALUATION OF DATA UTILITY FOR EARTH SCIENCES FROM METHODICAL POINT OF VIEW Progress Report, Feb. - Aug. 1973**

Harald Svensson, Principal Investigator 10 Oct. 1973 8 p refs Sponsored by NASA ERTS

(E73-11122; NASA-CR-135660) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following signficant results. A very distinct line representing the Ra-substage of the last deglaciation period is observable around the outer parts of the Oslo fjord. The moraine line is also traceable in some parts of the forest district on the Swedish side of the border forming part of the Central Swedish End Moraines. In the area of Lake Vanern to the southeast, the line is then again more distinct, partly due to the cultivation pattern. Outside the Central Swedish Moraine Line and nearer to the coast another not so distinct moraine line could be observed running NNW-SSE. This line crosses the coastline before reaching the Oslo fjord. Probably the moraine deposits on some outer islands in the fjord constitute part of this older moraine line. The study will be extended to districts of southern Sweden, where old moraine lines of the last deglaciation period are incompletely mapped.

**N73-33278*#** Nevada Univ., Reno. Mackay School of Mines.

**THE GREAT BASIN INVESTIGATION Monthly Progress Report, Sep. 1973**

Jack G. Quade, Principal Investigator Sep. 1973 2 p EREP

(Contract NAS9-13274)

(E73-11123; NASA-CR-135661) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

**N73-33279*#** Corps of Engineers, Champaign, Ill.

**EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY Progress Report, 9 Aug. - 8 Oct. 1973**

Ravinder K. Jain, Principal Investigator 8 Oct. 1973 2 p ERTS

(NASA Order S-70255-AG)

(E73-11124; NASA-CR-135662) Avail: NTIS HC $3.00

There are no author-identified significant results in this report.

**N73-33280*#** Mississippi State Univ., State College. Inst. for Environmental Studies.

**A STUDY OF THE APPLICATION OF SKYLAB EREP DATA TO AGRICULTURE IN THE MISSISSIPPI DELTA ALLUVIAL PLAINS REGION Quarterly Report, 23 Jul. - 23 Oct. 1973**

C. W. Bouchillon, Principal Investigator 23 Oct. 1973 5 p EREP

(Contract NAS9-13363)

(E73-11125; NASA-CR-135663; QR-2) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

**N73-33281*#** Smithsonian Astrophysical Observatory, Cambridge, Mass.

**MAPPING OF THE MAJOR STRUCTURES OF THE AFRICAN RIFT SYSTEM USING ERTS-1 Progress Report, 1 Jan. - 30 Jun. 1973**

Paul A. Mohr, Principal Investigator Oct. 1973 2 p ERTS

(Contract NAS5-21748)

(E73-11126; NASA-CR-135664) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

**N73-33282*#** Wyoming Univ., Laramie. Remote Sensing Lab.

**RECONNAISSANCE GEOLOGIC MAPPING IN THE DRY VALLEYS OF ANTARCTICA USING THE EARTH RESOURCES TECHNOLOGY SATELLITE Special Report**

Robert S. Houston, Principal Investigator, Frank W. Zochol, and Scott B. Smithson 5 Aug. 1973 33 p refs Original contains color imagery. Original photography may be purchased from

the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21818)
(E73-11127; NASA-CR-135665; ERTS-ANT-S-73A) Avail: NTIS HC $3.75 CSCL 08B

The author has identified the following significant results. Reconnassance geologic mapping can be done with 60-70% accuracy in the Dry Valleys of Antarctica using ERTS-1 imagery. Bedrock geology can be mapped much better than unconsolidated deposits of Quaternary age. Mapping of bedrock geology is facilitated by lack of vegetation, whereas mapping of Quaternary deposits is hindered by lack of vegetation. Antarctic images show remarkable clarity and under certain conditions (moderate relief, selection of the optimum band for specific rock types, stereo-viewing) irregular contacts can be mapped in local areas that are amazing like those mapped at a scale of 1:25,000, but, of course, lack details due to resolution limitations. ERTS-1 images should be a valuable aid to Antarctic geologists who have some limited ground truth and wish to extend boundaries of geologic mapping from known areas.

**N73-33283*#** Alaska Univ., Fairbanks.
**ERTS-A DATA AS A TEACHING AND RESEARCH TOOL IN THE DEPARTMENT OF GEOLOGY Bimonthly Progress Report**
Donald Grybeck, Principal Investigator 4 Oct. 1973 2 p ERTS
(Contract NAS5-21833)
(E73-11128; NASA-CR-135666; BMPR-6) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

**N73-33284*#** Environmental Research Inst. of Michigan, Ann Arbor.
**FRESH-WATER ICE INTERPRETATION FROM ERTS IMAGERY Bimonthly Report, 1 Jul. - 31 Aug. 1973**
M. Leonard Bryan, Principal Investigator 19 Sep. 1973 27 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21783)
(E73-11129; NASA-CR-135676; ERIM-193300-30-X; BMR-6) Avail: NTIS HC $3.50 CSCL 08L

There are no author-identified significant results in this report.

**N73-33285*#** Colorado School of Mines, Golden. Dept. of Geology.
**GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Monthly Progress Report, Sep. 1973**
Keenan Lee, Principal Investigator and Daniel H. Knepper, Jr. 19 Oct. 1973 5 p EREP
(Contract NAS9-13394)
(E73-11130; NASA-CR-135677) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

**N73-33286*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**APPLICATION OF ERTS AND EREP IMAGES TO GEOLOGIC INVESTIGATIONS OF THE BASIN AND RANGE - COLORADO PLATEAU BOUNDARY IN NORTHWESTERN AND NORTH-CENTRAL ARIZONA Progress Report, 15 Jun. - 15 Aug. 1973**
A. F. H. Goetz, Principal Investigator, F. C. Billingsley, D. P. Elston, I. Lucchitta, and E. M. Shoemaker 15 Oct. 1973 2 p Prepared in cooperation with Geol. Survey, Flagstaff, Ariz. and Calif. Inst. of Tech., Pasadena Sponsored by NASA ERTS
(E73-11131; NASA-CR-135678) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

**N73-33287*#** Purdue Univ., Lafayette, Ind. Lab. for Application of Remote Sensing.
**AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Sep. 1973**
Roger M. Hoffer, Principal Investigator Sep. 1973 6 p EREP
(Contract NAS9-13380)
(E73-11132; NASA-CR-135679) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

**N73-33288*#** Natural Resources Management Corp., Berkeley, Calif. Research and Development Div.
**INVESTIGATION OF THE DETECTION AND MONITORING OF FOREST INSECT INFESTATIONS IN THE SIERRA NEVADA MOUNTAINS OF CALIFORNIA Progress Report, 1 Aug. - 30 Sep. 1973**
Ralph C. Hall, Principal Investigator 30 Sep. 1973 5 p ERTS
(Contract NAS5-21770)
(E73-11133; NASA-CR-135680; NRM-1) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

**N73-33289*#** California Earth Science Corp., Santa Monica.
**FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report**
Paul M. Merifield, Principal Investigator 5 Oct. 1973 3 p EREP
(Contract NAS2-7698)
(E73-11134; NASA-CR-135681; MPR-4) Avail: NTIS HC $3.00 CSCL 08K

There are no author-identified significant results in this report.

**N73-33290*#** National Marine Fisheries Service, Bay Saint Louis, Miss.
**APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Monthly Progress Report, 10 Sep. - 10 Oct. 1973**
W. H. Stevenson, Principal Investigator 12 Oct. 1973 3 p EREP
(NASA Order T-8217-B)
(E73-11135; NASA-CR-135682; MPR-5) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

**N73-33291*#** Wyoming Univ., Laramie. Dept. of Geology.
**MULTIDISCIPLINARY STUDY OF WYOMING TEST SITES Progress Report, Jul. - Sep. 1973**
Robert S. Houston, Principal Investigator and Ronald W. Marrs 10 Oct. 1973 9 p EREP
(Contract NAS9-13298)
(E73-11136; NASA-CR-135683; EREP-1-73) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. Comparisons between ERTS-1 and EREP 70 mm images revealed that the EREP S-190A imagery is superior to ERTS-1 in spacial resolution but lacks tonal fidelity. However, tests of the S-192 screening film indicate that it will provide the necessary tonal fidelity for color additive work. No resolution comparisons were made with the S-192 imagery because the screening film, the only S-192 data currently available, does not represent an optimum quality product. Correlative ground truth data and aircraft imagery have been gathered for each of the EREP data passes. These data will not only serve as a primary means of calibrating EREP data and checking interpretations, but also aid in making decisions about optimum band combinations for S-190A and S-192.

**N73-33292*#** Alabama Univ., University. Bureau of Engineering Research.
**INVESTIGATIONS USING DATA IN ALABAMA FROM ERTS-A Bimonthly Progress Report, 7 Aug. - 6 Oct. 1973**
Harold R. Henry, George P. Whittle, Principal Investigators, and

James A. Drahovzal, comp. (Geol. Survey of Ala.) 7 Oct. 1973 151 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21876)
(E73-11137; NASA-CR-135684) Avail: NTIS HC $9.75 CSCL 05B

There are no author-identified significant results in this report.

**N73-33293*#** Boeing Co., Seattle, Wash.
**QUANTITATIVE DETERMINATION OF STRATOSPHERIC Monthly Report; Sep. 1973**
David L. Tingey, Principal Investigator Sep. 1973 1 p EREP
(Contract NAS9-13303)
(E73-11138; NASA-CR-135689) Avail: NTIS HC $3.00 CSCL 04A

There are no author-identified significant results in this report.

**N73-33294*#** Earth Satellite Corp., Washington, D.C.
**SAMPLING STRATEGIES IN LAND USE MAPPING USING SKYLAB DATA Monthly Progress Report, Sep. 1973**
David S. Simonett, Principal Investigator Sep. 1973 2 p EREP
(Contract NAS9-13314)
(E73-11139; NASA-CR-135690) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

**N73-33295*#** South Carolina State Development Board, Columbia.
**APPLICATION OF MULTISPECTRAL PHOTOGRAPHY TO MINERAL AND LAND RESOURCES OF SOUTH CAROLINA Quarterly Progress Report**
Norman K. Olson, Principal Investigator 15 Oct. 1973 4 p EREP
(Contract NAS8-29617)
(E73-11140; NASA-CR-135699; QPR-2) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

**N73-33296*#** Environmental Research Inst. of Michigan, Ann Arbor.
**SKYLAB - WATER DEPTH DETERMINATION Quarterly Progress Report, 1 Jun. - 30 Aug. 1973**
Fabian C. Polcyn, Principal Investigator 16 Oct. 1973 3 p EREP
(Contract NAS9-13278)
(E73-11141; NASA-CR-135700; ERIM-102100-5-L; QPR-2) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

**N73-33297*#** Environmental Research Inst. of Michigan, Ann Arbor.
**DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Sep. 1973**
Richard F. Nalepka and William A. Malila, Principal Investigators 9 Oct. 1973 3 p EREP
(Contract NAS9-13280)
(E73-11142; NASA-CR-135701; ERIM-101900-16-L; MPR-7) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

**N73-33298*#** Mitre Corp., McLean, Va.
**INVESTIGATION OF ENVIRONMENTAL INDICES FROM THE EARTH RESOURCES TECHNOLOGY SATELLITE Interim Report, Mar. - Aug. 1973**
E. A. Ward, Principal Investigator, E. L. Riley, and S. Stryker Aug. 1973 129 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21842)
(E73-11143; NASA-CR-135702; M73-206; IR-2) Avail: NTIS HC $8.50 CSCL 05B

There are no author-identified significant results in this report.

**N73-33299*#** Mekong Committee Secretariat, Bangkok (Thailand).
**AGRICULTURE/FORESTRY, METEOROLOGY, HYDROLOGY Final Report, Jul. 1972 - Aug. 1973**
W. J. VanderOord, Principal Investigator 23 Aug. 1973 11 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E73-11145; NASA-CR-135710) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

**N73-33300*#** Delaware Univ., Newark. Coll. of Marine Studies.
**APPLICATION OF ECOLOGICAL, GEOLOGICAL AND OCEANOGRAPHIC ERTS-1 IMAGERY TO DELAWARE'S COASTAL RESOURCES PLANNING: COASTAL VEGETATION, LAND USE, AND ENVIRONMENTAL IMPACT MAPPING**
V. Klemas, Principal Investigator [1973] 2 p ERTS
(Contract NAS5-21837)
(E73-11146; NASA-CR-135734) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

**N73-33301*#** Delaware Univ., Newark. Coll. of Marine Studies.
**APPLICATION OF ECOLOGICAL, GEOLOGICAL AND OCEANOGRAPHIC ERTS-1 IMAGERY TO DELAWARE'S COASTAL RESOURCES PLANNING: MONITORING WATER PROPERTIES AND MOVEMENTS - TURBIDITY, COLOR, BOUNDARIES, CIRCULATION, POLLUTION DISPERSION**
V. Klemas, Principal Investigator [1973] 3 p ERTS
(Contract NAS5-21837)
(E73-11147; NASA-CR-135735) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

**N73-33302*#** Indiana Geological Survey, Bloomington. Coal Section.
**APPLICATION OF EREP IMAGERY TO FRACTURE-RELATED MINE SAFETY HAZARDS AND ENVIRONMENTAL PROBLEMS IN MINING Quarterly Progress Report, 20 Jul. - 20 Oct. 1973**
Charles E. Wier, Frank J. Wobber, Roger V. Amato, and Orville R. Russell, Principal Investigators 22 Oct. 1973 8 p Prepared in cooperation with Earth Satellite Corp., Washington, D. C. EREP
(Contract NAS9-13358)
(E73-11148; NASA-CR-135736) Avail: NTIS HC $3.00 CSCL 08I

The author has identified the following significant results. Numerous fracture traces were detected on both the color transparencies and black and white spectral bands. Fracture traces of value to mining hazards analysis were noted on the EREP imagery which could not be detected on either the ERTS-1 or high altitude aircraft color infrared photography. Several areas of mine subsidence occurring in the Busseron Creek area near Sullivan, Indiana were successfully identified using color photography. Skylab photography affords an increase over comparable scale ERTS-1 imagery in level of information obtained in mined lands inventory and reclamation analysis. A review of EREP color photography permitted the identification of a substantial number of non-fuel mines within the Southern Indiana test area. A new mine was detected on the EREP photography without prior data. EREP has definite value for estimating areal changes in active mines and for detecting new non-fuel mines. Gob piles and slurry ponds of several acres could be detected on the S-190B color photography when observed in association with large scale mining operations. Apparent degradation of water quality resulting from acid mine drainage and/or siltation was

noted in several ponds or small lakes and appear to be related to intensive mining activity near Sullivan, Indiana.

**N73-33303*#** Earth Satellite Corp., Berkeley, Calif.
**PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Progress Report, 1-30 Sep. 1973**
Charles E. Poulton, Principal Investigator 30 Sep. 1973 8 p EREP
(Contract NAS9-13286)
(E73-11149; NASA-CR-135737; MPR-8) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

**N73-33304*#** Environmental Research Inst. of Michigan, Ann Arbor.
**STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Progress Report, Sep. 1973**
Irvin J. Sattinger, Principal Investigator 10 Oct. 1973 4 p EREP
(Contract NAS9-13283)
(E73-11150; NASA-CR-135738; ERIM-103300-11-L) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

**N73-33305*#** Iowa Univ., Iowa City. Dept. of Geology.
**EXPERIMENT TO EVALUATE FEASIBILITY OF UTILIZING SKYLAB-EREP REMOTE SENSING DATA FOR TECTONIC ANALYSIS OF THE BIGHORN MOUNTAINS REGION, WYOMING-MONTANA Quarterly Progress Report, 1 Jul. - 30 Sep. 1973**
Richard A. Hoppin, Principal Investigator 19 Oct. 1973 5 p EREP
(Contract NAS9-13313)
(E73-11151; NASA-CR-135739) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Excellent imagery has been obtained from SL-3 along track 5 across the Bighorn Mountains and track 19 across the northern Black Hills. The red band is by far the best of the four black and white films of S-190A. Excellent detail is visible of topography, structure, resistant lithologies, and culture with good resolution obtainable at high magnification (30X). The infrared bands do not have as good resolution and are grainy at high magnification. They are of use as a complement to the red band particularly for relief enhancement in areas of heavy green grass and forest cover. S-190B high definition black and white is comparable to the red band (S-190A) in detail. Its main advantage is larger initial scale and slightly better resolution. High resolution color transparencies along track 19 allow detailed delineation of cultivated land and strip mining. A group of folds northwest of Billings stand out clearly. Light colored units in northwestern Black Hills and in the badlands can be mapped in great detail.

**N73-33306*#** Michigan State Univ., East Lansing.
**[GROUND TRUTH ACQUISITION] Investigation of Skylab Data. Monthly Progress Report, Sep. 1973**
Lester V. Manderscheid, Principal Investigator Sep. 1973 2 p EREP
(Contract NAS9-13332)
(E73-11152; NASA-CR-135740) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

**N73-33307*#** Army Cold Regions Research and Engineering Lab., Hanover, N.H.
**MESOSCALE DEFORMATION OF SEA ICE FROM SATELLITE IMAGERY**
Duwayne M. Anderson, Principal Investigator, W. K. Crowder, H. L. McKim, S. F. Ackley, and W. D. Hibler, III 25 Oct. 1973 2 p Proposed for presentation at the Interdisciplinary Symp. on Advanced Concepts and Tech. in the Study of Snow and Ice Resources, Monterey, Calif., 2-6, Dec. 1973 ERTS
(NASA Order S-70253-AG)
(E73-11153; NASA-CR-135741) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

**N73-33308*#** Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Biology.
**THE USE OF ERTS-1 TO MORE FULLY UTILIZE AND APPLY MARINE STATION DATA TO THE STUDY OF PRODUCTIVITY ALONG THE EASTERN SHELF EXPANDED WATERS OF THE UNITED STATES Bimonthly Report, 1 Aug. - 31 Sep. 1973**
Harold G. Marshall, Principal Investigator 31 Sep. 1973 2 p ERTS
(Contract NAS5-21816)
(E73-11154; NASA-CR-135742) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

**N73-33309*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**EVALUATION AND COMPARISON OF ERTS MEASUREMENTS OF MAJOR CROPS AND SOIL ASSOCIATIONS FOR SELECTED SITES IN THE CENTRAL UNITED STATES Progress Report, 1 Jan. - 30 Jun. 1973**
Marion F. Baumgardner, Principal Investigator Aug. 1973 17 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21785)
(E73-11155; NASA-CR-135743) Avail: NTIS HC $3.00 CSCL 08M

There are no author-identified significant results in this report.

**N73-33310*#** Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
**INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF ERTS DATA WITHIN THE SUSQUEHANNA RIVER BASIN: RESOURCE INVENTORY, LAND USE, AND POLLUTION Progress Report, 1 Jun. - 30 Nov. 1972**
G. J. McMurtry and G. W. Petersen, Principal Investigators Dec. 1972 31 p refs ERTS
(Contract NAS5-23133)
(E73-11156; NASA-CR-135744) Avail: NTIS HC $3.75 CSCL 09B

There are no author-identified significant results in this report.

**N73-33311*#** National Marine Fisheries Service, Bay Saint Louis, Miss. Fisheries Engineering Lab.
**SKYLAB OCEANIC GAMEFISH PROJECT FIELD OPERATIONS REPORT, 2 JULY - 10 AUGUST 1973**
W. H. Stevenson and E. G. Woods, Principal Investigators 28 Sep. 1973 64 p refs EREP
(NASA Order T-8217-B)
(E73-11157; NASA-CR-135745) Avail: NTIS HC $5.25 CSCL 08G

There are no author-identified significant results in this report.

**N73-33312*#** Arizona Univ., Tucson. Dept. of Watershed Management.
**USE OF EARTH RESOURCES TECHNOLOGICAL SATELLITE (ERTS) DATA IN A NATURAL RESOURCE INVENTORY Progress Report, 1 Apr. - 30 Sep. 1973**
Phil R. Ogden, Principal Investigator 22 Oct. 1973 3 p ERTS
(Contract NAS5-21820)
(E73-11159; NASA-CR-135748) Avail: NTIS HC $3.00 CSCL 08M

There are no author-identified significant results in this report.

**N73-33313*#** State Power Board, Oslo (Norway).
**SNOW SURVEYING TO ASSESS RISK OF SPRING FLOOD**

**AND SNOW STORAGE IN AREAS OF HYDRO-POWER STATIONS**
Helge Odegaard, Principal Investigator 27 Sep. 1973 1 p Sponsored by NASA ERTS
(E73-11160; NASA-CR-135749) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

**N73-33314*#** Geological Survey, Washington, D.C.
**UTILIZATION OF REMOTELY-SENSED DATA IN THE MANAGEMENT OF INLAND WETLANDS**
Virginia Carter and Doyle G. Smith [1973] 15 p refs Prepared in cooperation with American Univ., Washington, D. C. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21752; NASA Order S-70243-AG)
(E73-11161; NASA-CR-135755) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. ERTS-1 data and aerial photography are proving to be a useful tool for the inventory and management of inland wetlands. Two examples of the application of remotely-sensed data to specific wetland management needs or requirements are discussed. Studies of the Great Dismal Swamp are utilizing ERTS-1 imagery and color IR photography in: (1) study area selection; (2) field inspection; (3) vegetation mapping; (4) identification of drainage characteristics and moisture regime; (5) location of intensive study areas; and (6) detection of change. Thematic extractions of ERTS-1 data made using the United States Geological Survey's Autographic Theme Extraction System are aiding analyses of swamp hydrologic regime and providing information pertinent to quick recognition and inventory of wetlands from ERTS-1. DCP'S in south Florida wetlands provide near-real time data for water resources managers. Data relayed by satellite can be entered into models to provide predictive data and water storage information for long-term and short-term decision making.

**N73-33315*#** Geological Survey, Washington, D.C.
**INVESTIGATION OF SKYLAB IMAGERY FOR APPLICATION TO THEMATIC MAPPING Quarterly Progress Report, 1 May - 31 Jul. 1973**
Doyle G. Smith, Principal Investigator 15 Aug. 1973 2 p EREP
(NASA Order T-4649-B)
(E73-11162; NASA-CR-135756) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

**N73-33316*#** California Univ., Berkeley. Center for Remote Sensing Research.
**AGRICULTURAL INTERPRETATION TECHNIQUE DEVELOPMENT Quarterly Progress Report**
Robert N. Colwell, Andrew S. Benson, Principal Investigators, and James D. Nichols 31 Aug. 1973 12 p EREP
(Contract NAS2-7567)
(E73-11163; NASA-CR-135757) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

**N73-33317*#** Delaware Univ., Newark. Coll. of Marine Studies.
**MONITORING COASTAL WATER PROPERTIES AND CIRCULATION FROM ERTS-1 Report on Significant Results**
V. Klemas, Principal Investigator 30 Oct. 1973 4 p refs ERTS
(Contract NAS5-21837)
(E73-11164; NASA-CR-135758) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

**N73-33318*#** Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources (ORSER).
**INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF ERTS DATA WITHIN THE SUSQUEHANNA RIVER BASIN Progress Report, Feb. - Mar. 1973**
G. J. McMurtry and G. W. Petersen, Principal Investigators 31 Mar. 1973 14 p refs ERTS
(Contract NAS5-23133)
(E73-11165; NASA-CR-135759; ORSER-SSEL-TR-8-73) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

**N73-33319*#** Montana Univ., Missoula. Montana Cooperative Wildlife Research Unit.
**AN EVALUATION OF THE USE OF ERTS-1 SATELLITE IMAGERY FOR GRIZZLY BEAR HABITAT ANALYSIS Progress Report**
Joel R. Varney, John J. Craighead, and Jay Sumner 28 Aug. 1973 33 p refs
(Grant NGR-27-002-006)
(NASA-CR-135776) Avail: NTIS HC $3.75 CSCL 06C

Multispectral scanner images taken by the ERTS-1 satellite in August and October, 1972, were examined to determine if they would be useful in identifying and mapping favorable habitat for grizzly bears. It was possible to identify areas having a suitable mixture of alpine meadow and timber, and to eliminate those which did not meet the isolation requirements of grizzlies because of farming or grazing activity. High altitude timbered areas mapped from satellite imagery agreed reasonably well with the distribution of whitebark pine, an important food species. Analysis of satellite imagery appears to be a valuable supplement to present ground observation methods, since it allows the most important areas to be identified for intensive study and many others to be eliminated from consideration. A sampling plan can be developed from such data which will minimize field effort and overall program cost. Author

**N73-33320*#** Michigan Univ., Ann Arbor. Space Physics Research Lab.
**OGO-6 NEUTRAL ATMOSPHERIC COMPOSITION EXPERIMENT Final Report**
D. R. Taeusch Sep. 1973 7 p refs
(Grant NGR-23-005-561)
Avail: NTIS HC $3.00 CSCL 04A

The continued analysis of data obtained from the neutral atmospheric composition experiment flown on OGO-V6 is discussed. The effort was directed toward the study of five specific areas of interest for which the OGO-V6 data were especially useful. Author

**N73-33321*#** Texas Univ., Dallas.
**INVESTIGATION INTO THE MECHANISM AND RATES OF ATMOSPHERIC MIXING IN THE LOWER THERMOSPHERE Semiannual Status Report, period ending 15 Mar. 1973**
Francis S. Johnson et al 5 Oct. 1973 25 p refs
(Grant NGL-44-004-026)
(NASA-CR-135789) Avail: NTIS HC $3.25 CSCL 04A

Three separate studies are reported which include: (1) an analysis of energy input to the lower thermosphere, (2) data analyses of OGO-6 onboard retarding potential analyzer measurements, and (3) an investigation of the sharp cutoff in plasma in plasma density of the Venus ionosphere as observed by Mariner 5. D.L.G.

**N73-33322#** Ionospharen-Institut Breisach (West Germany).
**IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE-31 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 31]**
Jul. 1973 44 p refs In GERMAN and ENGLISH
Avail: NTIS HC $4.25

Daily summaries are presented for vertical echo sounding of the upper atmosphere during July 1973. The data include charts of median values for the E- and F-regions. Author

**N73-33323** Department of Energy, Mines and Resources, Ottawa (Ontario).
**RECORD OF OBSERVATIONS AT VICTORIA MAGNETIC OBSERVATORY, 1971 Publications of the Earth Physics Branch, Volume 44, No. 4**

D. R. Auld and C. W. Walker 1973 56 p refs
(M70-44/4) Copyright. Avail: Issuing Activity

Magnetic observations for 1971 are presented. A digitally recording magnetometer recorded the values of D, H, Z, and F once per minute. The magnetic equipment used in acquiring the data is described, and absolute observations and baseline values are given. Magnetic reductions are discussed, and a summary of annual mean values is given. Tables are presented for: hourly values of horizonal intensity, declination and vertical intensity; summary by month, season, and year of the mean hourly values of H, D, and Z; and three-hour range indices. K.M.M.

**N73-33324#** Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
**[FIELD OPERATIONS AND LABORATORY STUDIES IN AUSTRALIA FOR MINERAL RESEARCH, GEOLOGY, AND GEOPHYSICS] Annual Report, 1972**
1972 88 p refs
Avail: NTIS HC $6.50

Activities of the Australian BMR for 1972 are reported. Topics discussed include: field operations in the territories; laboratory studies; seismic, magnetic, and gravity surveys; instrument and systems design and development; mineral resources; and information services. F.O.S.

**N73-33325#** Japan Meteorological Agency, Tokyo.
**AEROLOGICAL DATA OF JAPAN, DECEMBER 1972. APPENDIX: ATMOSPHERIC OZONE DATA FOR JANUARY - DECEMBER 1972**
1973 319 p refs
Avail: NTIS HC $18.00

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

**N73-33326*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**STUDY OF EQUATORIAL SCINTILLATIONS Progress Report**
Jose Pomalaza (Inst. Geofis. del Peru), Ronald Woodman (Inst. Geofis. del Peru), Gilberto Tisnado (Inst. Geofis. del Peru), and Eduardo Nakasone (Inst. Geofis. del Peru) Dec. 1972 31 p refs
(NASA-TM-X-70478; X-750-73-244) Avail: NTIS HC $3.75 CSCL 04A

Observations of the amplitude scintillations produced by the F-region in equatorial areas are presented. The equipment used for conducting the observations is described. The use of transmissions from the ATS-1, ATS-3, and ATS-5 for obtaining data is described. The two principal subjects discussed are: (1) correlation between satellite and incoherent radar observations of scintillations and (2) simultaneous observations of scintillations at 136 MHz and 1550 MHz. Author

**N73-33327*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**AN ANALYTICAL ANALYSIS OF THE DISPERSION PREDICTIONS FOR EFFLUENTS FROM THE SATURN 5 AND SCOUT-ALGOL 3 ROCKET EXHAUSTS**
J. Briscoe Stephens, Michael Susko, John W. Kaufman, and C. Kelly Hill Washington Oct. 1973 87 p refs
(NASA-TM-X-2935; M-115) Avail: NTIS HC $3.75 CSCL 04A

Predictions of the spatial concentration mapping of the potentially toxic constituents of the exhaust effluents from a launch of a Saturn 5 and of a Scout-Algol 3 vehicle utilizing the NASA/MSFC Multilayer Diffusion Program are provided. In the case of the Saturn 5, special attention was given to the concentration fields of carbon monoxide with a correlation of carbon dioxide concentrations. The Scout-Algol 3 provided an example of the centerline concentrations of hydrogen chloride, carbon monoxide, and alumina under typical meteorological conditions. While these results define the specific environmental impact of these two launches under the meteorological conditions existing during launches, they also provide a basis for the empirical monitoring of the constituents of the exhaust effluents of these vehicles. Author

**N73-33328#** National Environmental Satellite Service, Washington, D.C. Spacecraft Oceanography Group.
**SKYLAB EARTH RESOURCES EXPERIMENT PACKAGE EXPERIMENTS IN OCEANOGRAPHY AND MARINE SCIENCE**
A. L. Grabham and John W. Sherman, III Sep. 1973 79 p refs
(NOAA-TM-NESS-51) Avail: NTIS HC $6.00

A reference for marine scientists for coordination and exchange of information in connection with the Skylab Earth Resources Experiment Package (EREP) missions of 1973 is presented. The experiments planned, the experiment package used, the methods for handling data, and the schedule for ships for potential ocean ground truth data are listed and described. Author

**N73-33329#** Illinois Univ., Urbana. Aeronomy Lab.
**THE F 1 REGION DURING A SOLAR ECLIPSE**
W. L. Oliver and S. A. Bowhill [1973] 22 p refs Submitted for publication
(Grant NSF GA-27295)
Avail: NTIS HC $3.25

Temperature and ion composition results obtained during the eclipse of 7 March 1970 at Millstone Hill are presented. The temperature variations appear to be controlled by the high degree of magnetic activity present on the eclipse day. Ion composition variations may be explained in terms of photochemical processes and the distribution of ionizing radiation across the solar disk. The data indicate the quality of ion composition determination by incoherent scatter radar, and it is concluded that these data are more useful when averaged in quantity to determine diurnal, seasonal, and solar cycle variations rather than short term temporal variations on a given day. Author

**N73-33330*#** Eastman Kodak Co., Rochester, N.Y. Kodak Apparatus Div.
**TECHNICAL CONSULTING SERVICES FOR EARTH RESOURCES PROGRAM Monthly Status Report**
30 Sep. 1973 9 p
(Contract NASw-2317)
(NASA-CR-135793) Avail: NTIS HC $3.00 CSCL 05A

Evaluations of several sets of test data which show a normal amount of variability in gamma and Dmax on KODAK Aerial Duplicating Film (ESTAR Base) SO-467 are reported. Kodak is now furnishing to engineers at GSFC a full set of test data for each coating of SO-467 film. Glass-enclosed sensitometer step tablets which are being made for the Herrnfeld instrument at GSFC are discussed. These tablets include a gray scale and uniformity check areas as well as tribar resolution patterns imaged in a durable chromium layer. It is recommended that the Sioux Falls EDC procure four new enlarging printers and study the value and economics of a system for printer automation based on edge coding. Author

**N73-33331#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**ON HYDROMAGNETIC GRADIENT WAVES IN THE IONOSPHERE**
A. G. Khantadze [1973] 8 p refs Transl. into English from Geomagnetizm i Aeronomiya (Moscow), v. 13, no. 4, 1973 p 624-630
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Large perturbations in the ionosphere are discussed as the magnetic analog of Rossby waves. It is shown that changes in the geomagnetic field with latitude generate wave motions in the ionosphere, which are hydromagnetic waves (HMG). The HMG are bounded by the same space and time scales as the Rossby waves. Author

**N73-33332#** Arizona Univ., Tucson. Engineering Experiment Station.
**DAYTIME NOISE ENVIRONMENT IN TUCSON, ARIZONA**
Vesta B. Conley and M. R. Bottaccini Jul. 1973 78 p refs
(EE-Ser-40) Avail: NTIS HC $6.00

A summary of a three year noise environment study is reported, which was conducted for the purpose of defining the noise problem in Tucson, and of providing the community with information concerning the source of noise and the sound levels produced by the sources. The area within the Tucson City Limits was surveyed and all known sources of noise identified. Traffic, airports, railroads and industrial areas were examined and sound levels measured during daylight hours. It was discovered that most outdoor noise in Tucson is produced by automobiles, trucks, aircraft, and railroad trains. Industry is not a major noise source at this time (1973). Author

**N73-33333*#** Linguistic Systems, Inc., Cambridge, Mass.
**THE FRALIT PROGRAM (ERTS-1): A REPORT PREPARED FOR THE OCCASION OF THE THIRTIETH INTERNATIONAL AERONAUTICS AND SPACE EXHIBITION**
P. DeMathieu and F. Verger Washington NASA Oct. 1973 34 p refs Transl. into ENGLISH of the publ. "Le Programme Fralit (ERTS-1): Notice preparee a l'occasion du 30eme Salon International de l'Aeronautique et de l'Espace" France, Le Bourget, May 1973 28 p
(Contract NASw-2824)
(NASA-TT-F-15063) Avail: NTIS HC $3.75 CSCL 05A

Under the FRALit (French Atlantic Littoral) project, the result of collaboration between three French institutions and NASA, French laboratories are studying and reporting on records derived from ERTS-1. Marshy ocean coast areas and sedimentary material in the water bordering these areas are being studied. The records include digitized magnetic tape and composite color printing. Data are furnished in four spectral bands for each unit area, enabling increasingly complex charts to be prepared. The initial results on shoreline deposits, geomorphology of the inlets, and geography of the salt marshes were productive. Author

**N73-33334*#** Kanner (Leo) Associates, Redwood City, Calif.
**A STUDY OF POLAR MOTION M.S. Thesis**
A. Terpos Washington NASA Oct. 1973 249 p refs Transl. into ENGLISH of "Peri Tes Kineseos Tou Polou Tes Ges", Thessalonik Univ., Div. of Rural and Surveying Eng., Greece, M.S. Thesis, 1971 287 p
(Contract NASw-2481)
(NASA-TT-F-15066) Avail: NTIS HC $14.50 CSCL 08E

Field measurements relative to polar motion and a model of the earth that will give the expected results are presented. The changes in the axis of rotation as a result of precession, nutation, and wobble are discussed, and their causes are investigated. Methods of observation and the establishment of a general coordinate system as a master reference for latitude measurements are described. Initial data from five ILS stations are included. Possible errors in azimuth and inclination data are treated, along with correction methods, emphasizing the chain method. The model of the earth is based on the earth's ability to react to the forces of nature; the earth is considered as essentially stable and solid. Theories treating the earth as an elastic body are also discussed. Tensor analysis is employed throughout. Author

**N73-33335*#** Linguistic Systems, Inc., Cambridge, Mass.
**ON THE PROBLEM OF PHOTOGRAMMETRIC REFRACTION**
S. V. Gromov Washington NASA Oct. 1973 13 p Transl. into ENGLISH from Tr. Astron. Observ. (Leningrad), v. 29, 1973 p 207-214
(Contract NASw-2482)
(NASA-TT-F-15074) Avail: NTIS HC $3.00

The angles of photogrammetric refractions are derived through the total refraction A. For A, an expression is given where two terms, S sub 1 and S sub 2, are introduced for the calculation of the relation for the distribution of the density of the atmosphere from the surface of the earth to the point of photography. The density of the atmosphere is assumed for the calculation of S sub 1 and S sub 2 and it is approximated regionally. The components of S are given for each region; the method of computation of A is shown when i sub 1 (the inclination of the ray with respect to the vertical) does not change. The method of the photogrammetric refraction is completed up to the practical use for high altitude surveys. Author

**N73-33336#** Texas Univ., Austin. Atmospheric Science Group.
**ANALYSIS OF SOME AIRBORNE INFRARED RADIATION MEASUREMENTS OF SURFACE TEMPERATURE ALONG THE UPPER TEXAS COAST, 14-17 JUNE 1968**
Hsing-Wu Wu and Kenneth H. Jehn Jun. 1973 33 p refs (Grant NSF GA-16167)
(Rept-36) Avail: NTIS HC $3.75

Surface temperatures were measured along the upper Texas coast in June 1968, using an airborne infrared radiometer, as part of the investigation of the sea/land breeze circulation. These data in the light of correction techniques are examined. Characteristic distributions of land and water surface temperatures in the sea breeze area as a function of time of day are also presented. Author

**N73-33337*#** Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
**KENNEDY SPACE CENTER OCEAN BEACH EROSION**
A. J. Mehta and M. P. OBrien Jun. 1973 66 p refs (Contract NAS10-8297)
(NASA-CR-135775) Avail: NTIS HC $5.50 CSCL 08C

Dune barrier erosion and possible breakthrough due to storm and hurricane wave activity is studied near Mosquito Lagoon, in Kennedy Space Center property. The results of a geological as well as hydrodynamic appraisal of the problem area indicate that no inlet has existed across the dune barrier since 500 A.D., and that there is little likelihood of a possible breakthrough inlet remaining open permanently, primarily because the relatively shallow lagoon does not contain enough volume of water to maintain an inlet between the ocean and the lagoon. It is therefore recommended that only minimal measures, such as closing up the man-made passes across the dunes, be carried out to ensure continuation of the action of natural beach maintaining processes. Author

**N73-33338#** Helsinki Univ. of Technology, Otaniemi (Finland).
**SPRING FLOW FORECASTING AND SNOW DATA NETWORK DESIGN IN THE SEITAKORVA BASIN**
Ibrahim Guerer 1973 128 p refs
Avail: NTIS HC $8.50

A forecasting method is reported for spring runoff mainly due to snow melting and precipitation for the Seitakorva hydropower plant and to investigate possibilities of improving the network necessary for reliable snow data collection. Various approaches for forecasting spring flow for the whole watershed as a single unit are considered. Besides the two different flood flow periods, the snow water equivalents on different dates and various periods for total precipitation successive to snow water equivalent observation data are examined. Author

**N73-33339#** Zentralanstalt fuer Meteorologie und Geodynamik, Vienna (Austria).
**MEASUREMENT OF THE RADIOACTIVITY IN THE ATMOSPHERE IN THE YEAR 1972**
1972 13 p In GERMAN
(NP-19753) Avail: AEC Depository Libraries HC $3.00

Low atmospheric radioactivity measurement data obtained 1973 at Vienna, Austria, are presented in table form.
Transl. by G.G.

**N73-33340#** Zentralanstalt fuer Meteorologie und Geodynamik, Vienna (Austria).
**THREE HOUR MEASUREMENT OF THE RADIOACTIVITY IN THE ATMOSPHERE CLOSE TO THE EARTH IN THE YEAR 1972**
1972 13 p In GREEK
(NP-19751) Avail: AEC Depository Libraries HC 43.00

Observations of lower atmosphere radiation levels in the vicinity of Vienna, Austria were conducted. The observations were made at three hour intervals for each day during 1972. Results of the observations are presented in tabular form. P.N.F.

**N73-33341#** California Univ., Livermore. Lawrence Livermore Lab.
**ATMOSPHERIC MODELING AND ENVIRONMENTAL PROTECTION NEEDS**
J. B. Knox 9 Oct. 1972 16 p refs Presented at the Interagency

Conf. on the Environ., Livermore, Calif., 17-19 Oct. 1972 Sponsored by AEC
(UCRL-74249; Conf-721002-3) Avail: NTIS HC $3.00

Results are reported from a survey of the atmospheric modeling capabilities of the National Laboratories pertinent to the key present-day environmental questions. The needs of the Environmental Protection Agency (EPA) for atmospheric modeling to provide a scientific basis for the improvement of ambient air quality and the operational use of regional air pollution models for the design and implementation of measures of control during air pollution episodes are briefly reviewed. The air quality models presently being developed calculate the transport and diffusion of passive and reactive pollutants assuming the required meteorological fields of horizontal wind, height of the mixed layer, horizontal and vertical eddy diffusivities are known or predicted on an appropriate scale. The need for an adequate data base for the development of coupled hydrodynamical-reactive pollutant models with predicted meteorology and the subsequent model verification and application is emphasized. NSA

**N73-33342#** Atomic Energy Commission, Washington, D.C. Div. of Biomedical and Environmental Research.
**CHEMIST-METEOROLOGIST WORKSHOP, FT. LAUDERDALE, FLORIDA, JANUARY 1972**
1972 64 p refs
(WASH-1217) Avail: NTIS HC $5.45

Summaries and recommendations are presented for the four panel discussions held at the second Fort Lauderdale workshop, the purpose of which was an exchange of ideas between chemists and meteorologists. Topics discussed by the four panels were: stratospheric trace substance sampling and measurement, the cycle of gaseous and particulate trace substances in the atmosphere, atmospheric-hydrosphere interactions, and regional studies of atmospheric pollution from near-surface sources. NSA

**N73-33343#** Bergen Univ. (Norway). Dept. of Physics.
**POSSIBILITIES FOR LARGE-SCALE BALLOON RECORDINGS OF AURORAL-ZONE X-RAY EVENTS FROM NORTHERN SCANDINAVIA TO GREENLAND, AND THEIR COORDINATION WITH GEOS SATELLITE MEASUREMENTS**
H. Trefall Jan. 1973 19 p refs
(NP-19738; STR-51) Avail: AEC Depository Libraries HC $3.00

Ways to solve the practical problems associated with large-scale simultaneous balloon recordings of auroral zone X-rays in the region from Scandinavia to eastern Greenland are considered. Suggestions are made for cooperative programs between balloon recordings of X-rays from electron precipitation events and GEOS satellite measurements. A scheme for longitudinal shift maneuvers of the satellite is proposed with such measurements in mind. Author (NSA)

**N73-33344#** Arizona State Univ., Tempe.
**PROCEEDINGS OF THE TENTH RARE EARTH RESEARCH CONFERENCE**
C. J. Kevane, ed. and T. Moeller, ed. 1973 1229 p refs Conf. held at Carefree, Ariz., 30 Apr. - 3 May 1973 Sponsored by AEC
(Conf-730402-(P1-2)) Avail: NTIS CSCL 08G

Analysis of seven rare earths (Nd, Sm, Eu, Gd, Dy, Er, Yb) is extended to La and Lu, and use is made of new standard and spike solutions to guard against atmospheric contamination. Results are compared for Luna 20, Apollo 11 to 15, and Luna 16. The Eu depletion in the moon is noted. NSA

**N73-33345#** Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
**TRANSPORT PROCESSES AND TRACE CONSTITUENTS IN THE STRATOSPHERE Progress Report, 20 Nov. 1972 - 30 Jun. 1973**
D. M. Cunnold 2 Apr. 1973 91 p refs
(Contract AT(11-1)-2249)
(COO-2249-2) Avail: NTIS HC $6.75

A numerical model for stratospheric processes and the effects of trace contaminants is developed. Computer codes have been written for evaluating the vertical column concentration of ozone, photodissociation effects, and atmospheric heating rates produced by contaminants. G.G.

**N73-33346#** Alaska Univ., College. Geophysical Inst.
**STUDY OF MAGNETOSPHERIC SUBSTORMS IN CONJUNCTION WITH THE VELA SATELLITE DATA Annual Progress Report**
S. I. Akasofu Apr. 1973 6 p refs
(Contract AT(45-1)-2229)
(RLO-2229-T-5-3) Avail: NTIS HC $3.00

Progress is reported on a project to examine the complex behavior of the plasma sheet during magnetospheric substorms using Vela satellite data and simulataneous ground data, such as all-sky photographs and magnetic records. NSA

**N73-33347#** Los Alamos Scientific Lab., N.Mex.
**EFFECTS OF TURBULENCE ON LOW ALTITUDE FIREBALLS AT LATE TIMES**
H. M. Ruppel and R. M. Gentry [1973] 17 p refs Sponsored in part by Defense Nucl. Agency
(Contract W-7405-eng-36)
(LA-UR-73-713; Conf-730442-4) Avail: NTIS HC $3.00

The effects of turbulence on the dynamics of fireballs are discussed with a review of the turbulence model currently in use at Los Alamos. NSA

**N73-33348#** Los Alamos Scientific Lab., N.Mex.
**COMPARISON OF LOCKHEED AND AFWL BASED ABSORPTION COEFFICIENTS FOR AIR**
Arthur N. Cox and James E. Tabor [1972] 15 p Sponsored by AEC
(LA-UR-73-708; Conf-730442-3) Avail: NTIS HC $3.00

An extensive compilation of air absorption and scattering coefficients based on an Air Force Weapons Laboratory tape containing molecular and atomic continuum (no lines) absorptions has been available since July 1972. The atomic lines, scattering and both absorption and scattering coefficients above the 30,000 K upper limit of the AFWL data as well as other necessary features, were added to complete the tabulation. The data have been used extensively in fireball calculations at Los Alamos. Now a similar tabulation has been made based on molecular cross-section data directly from lockheed. All atomic continuum and line absorption and scattering as well as the higher temperature data have been added similarly to the AFWL based tabulation. Comparisons between the two absorption and scattering coefficient compilations are presented. Author (NSA)

**N73-33349#** Los Alamos Scientific Lab., N.Mex.
**STRIATION OF THE ION CLOUD PRODUCED IN THE OOSIK EXPERIMENT**
P. J. Bottoms and M. S. Tierney 2 May 1973 13 p refs
(Contract W-7405-eng-36)
(LA-UR-73-677; Conf-730442-1) Avail: NTIS HC $3.00

Oosik was the name given to a barium release experiment carried out on Mar. 7, 1972, with the intention of tracing an L approximately 6.75 field line from the northern conjugate to the magnetic equator. Several possible mechanisms are examined that could have caused the striation of the Oosik fast ion jet. NSA

**N73-33350#** Institut Royal Meteorologique de Belgique, Brussels.
**IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jan. 1973 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE. BULLETIN MENSUEL, JANVIER 1973]**
Jan. 1973 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for January 1973. ESRO

**N73-33351#** Institut Royal Meteorologique de Belgique, Brussels.
**IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Feb. 1973 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE. BULLETIN MENSUEL, FEVRIER 1973]**

Feb. 1973 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes, Belgium are tabulated for February 1973. ESRO

**N73-33352#** Institut Royal Meteorologique de Belgique, Brussels.
**GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Oct. 1972 [OBSERVATIONS GEOPHYSIQUES. BULLETIN MENSUEL, OCTOBRE 1972]**
Oct. 1972 26 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes, Belgium relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during October 1972 are presented. ESRO

**N73-33353#** Institut Royal Meteorologique de Belgique, Brussels.
**GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Nov. 1972 [OBSERVATIONS GEOPHYSIQUES. BULLETIN MENSUEL, NOVEMBRE 1972]**
Nov. 1972 26 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during November 1972 are presented. ESRO

**N73-33354#** Institut Royal Meteorologique de Belgique, Brussels.
**GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Dec. 1972 [OBSERVATIONS GEOPHYSIQUES. BULLETIN MENSUEL, DECEMBRE 1972]**
Dec. 1972 26 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during December 1972 are presented. ESRO

**N73-33355#** Army Cold Regions Research and Engineering Lab., Hanover, N.H.
**EFFECT OF SALINITY ON THE OPTICAL EXTINCTION OF SEA ICE AT 6328 A**
Hurley Davis and Richard H. Munis Jul. 1973 19 p
(AD-763882; CRREL-RR-308) Avail: NTIS CSCL 08/10

An investigation is made into the determination of the relationship between the extinction coefficient and the salinity of sea ice. A HeNe laser is used to propagate a beam of red light, of wavelength 6328A, through a series of ice samples at -20C. The optical extinction coefficients were calculated and plotted against the measured salinities. The results of the experiment indicated an exponential relationship between extinction coefficient and salinity. The relationship may be described by the equation: y = 2.41 plus 0.001 exp (1.19x) where y is the extinction coefficient and x is the salinity. Author (GRA)

**N73-33356#** Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
**THE DETERMINATION OF IONOSPHERIC PARAMETERS FROM TRANSDUCER DATA Final Report, 1 Dec. 1969 - 30 Nov. 1972**
Dennis E. Delorey and Phillip H. Trent 31 Dec. 1972 44 p ref
(Contract F19628-70-C-0135)
(AD-764781; AFCRL-TR-73-0303) Avail: NTIS CSCL 04/1

The development of a data analysis system to be used in the analysis of the data from multi-probe rockets is described. Common elements in the analysis of particular experiments are incorporated into the system by use of subroutines. These common elements are described and categorized. The application of the system to various experiments is outlined, descriptions of some of the analysis techniques employed are introduced and the output displays are discussed. Author (GRA)

**N73-33357#** Transportation Systems Center, Cambridge, Mass.
**PROCEEDINGS OF THE SECOND CONFERENCE ON THE CLIMATIC IMPACT ASSESSMENT PROGRAM,**
Anthony J. Broderick Apr. 1973 438 p refs Conf. held at Cambridge, Mass., 14-17 Nov. 1972
(Contract DOT-PPA-OS-320)
(PB-221166/2; DOT-TSC-OST-73-4) Avail: NTIS HC $10.60 CSCL 04A

This volume contains the proceedings of the Second Conference on the Climatic Impact Assessment Program (CIAP), held at the DOT Transportation Systems Center on November 14-17, 1972. It includes 37 invited papers, four unscheduled presentations, three edited panel discussions, and edited question-and-answer session following some of the papers. The conference was essentially a progress report on CIAP. Therefore, some of the papers contain new data not yet published elsewhere, others describe detailed experiment plans or hardware for use in the near future, and a few deal with proposed investigations which may be directly relevant to CIAP. The subjects covered include aircraft-engine emissions, the nature of the 'undisturbed' stratosphere of 1974, the nature of the 'perturbed' stratosphere of 1990-2025, the possible resulting tropospheric perturbations, and the biological and economic effects of such perturbations. Author (GRA)

**N73-33358#** Hydronautics, Inc., Laurel, Md.
**THE INFLUENCES OF WIND DRIFT AND CAPILLARITY ON BLOCKAGE**
O. M. Phillips May 1973 29 p refs
(Contract N00014-72-C-0509; NR Proj. 062-472)
(AD-764559; TR-7211-1) Avail: NTIS CSCL 08/3

The surface drift in the upper few centimeters of the ocean surface, produced by wind shear, is shown to modify substantially the propagation speed and energy flux of short surface waves. Two simple models are used to estimate the magnitude of the effect, a two-layer model described by G. I. Taylor and one in which the surface drift is a decaying exponential. When the waves encounter a moving current pattern of the type that would otherwise lead to blockage, the wind drift, augmenting the energy flux of the short waves, is shown to delay or prevent blockage. The modifications introduced by capillary effects in short gravity waves are also examined; surface tension provides an additional delay to possible blockage, but in cases of interest the modification is much less significant. Author (GRA)

**N73-33359#** Wesleyan Univ., Middletown, Conn.
**A SECOND GENERATION LASER-INTERFEROMETER SYSTEM FOR THE ABSOLUTE DETERMINATION OF THE ACCELERATION OF GRAVITY Final Report, 1 Apr. 1971 - 31 Dec. 1972**
James E. Faller 1 Jun. 1973 16 p
(Contract F19628-71-C-0133; AF Proj. 8607)
(AD-764831; AFCRL-TR-73-0345) Avail: NTIS CSCL 08/5

The acceleration due to gravity at a particular site is an important quantity for several purposes. It contributes to the general knowledge about the earth's gravity field and provides a calibration point for geodetic (relative) gravity meters. Its value comes into the determinations of several fundamental constants because of the definition of the ampere being based on the force between two wires with current flowing in them. The local acceleration of gravity together with a standard mass provides the most precisely known force in a laboratory. Precise measurements of g over extended periods of time with a drift-free instrument could possibly demonstrate long period effects of a geophysical or cosmological origin. A new second generation instrument for the measurement of this important physical quantity is being built and its design, together with some details of construction, are discussed in the report. Author (GRA)

**N73-33360#** Naval Research Lab., Washington, D.C.
**DETERMINATION OF OCEAN SURFACE DESCRIPTORS USING SEA PHOTO ANALYSIS TECHNIQUES Final Report**
Roger O. Pilon 18 Jul. 1973 39 p
(Contract DOT-FA71WAI-220)
(AD-764858; NRL-7574) Avail: NTIS CSCL 08/3

The techniques of Sea Photo Analysis have been used to

obtain surface truth descriptors of the open ocean from an aircraft. Aerial photographs were taken such that the density fluctuations of the negatives were related to surface slope. The slope spectra, obtained by Fourier analysis of the negatives, were fitted to an equivalent form of the Pierson-Moskowitz wave height spectrum. The photographs, the wave height spectrum, and the rms slope equations determined by Cox and Munk then yielded the averaged heading of the waves, the equivalent wind speed, the rms wave height, and the rms slope for clean and slick surfaces. The optical techniques of Sea Photo Analysis used in this program and digital analysis, used when whitecaps were present in the photographs, are discussed. The empirical equations used to determine rms wave height and slope and auxiliary rms slope and wave height spectrum equations are given. Surface descriptors were inferred for seas driven by winds from 3 to 21 knots occurring on 16 separate days. Author (GRA)

**N73-33533** Joint Publications Research Service, Arlington, Va.
**STRUCTURE OF GLOBAL GEOPOTENTIAL FIELDS IN CONNECTION WITH THE QUASI-BIANNUAL CYCLICITY IN THE EQUATORIAL STRATOSPHERE**
A. A. Pavlovskaya *In its* Meteorol. and Hydrol., No. 7, 1973 (JPRS-60164) 28 Sep. 1973 p 27-41 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 24-35 (For availability see N73-33530 24-20)

**N73-33535** Joint Publications Research Service, Arlington, Va.
**SPATIAL STRUCTURE OF TEMPERATURE FLUCTUATIONS IN THE SEA**
L. K. Kramareva *In its* Meteorol. and Hydrol., No. 7, 1973 (JPRS-60164) 28 Sep. 1973 p 54-61 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 55-60 (For availability see N73-33530 24-20)

**N73-33538** Joint Publications Research Service, Arlington, Va.
**HYDROLOGIC RESEARCH IN REPRESENTATIVE AND EXPERIMENTAL RIVER BASINS**
K. P. Voskresenskiy *In its* Meteorol. and Hydrol., No. 7, 1973 (JPRS-60164) 28 Sep. 1973 p 86-92 Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 112-115 (For availability see N73-33530 24-20)

**N73-33620** Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France). Div. des Previsions Ionospheriques.
**INTRODUCTION TO THE ELECTROMAGNETISM OF THE SEA [INTRODUCTION A L'ELECTROMAGNETISME DES MERS]**
P. Halley *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 38 p refs In FRENCH (For availability see N73-33619 24-23)

**N73-33621** Institute of Physical Oceanography, Copenhagen (Denmark).
**RADIANCE DISTRIBUTION BELOW THE SEA SURFACE**
Kjell Nygard *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 22 p refs (For availability see N73-33619 24-23)

**N73-33765** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).
**THALLASSIC AND THE ARTIFICIAL RISE OF WATER [THALASSIES ET REMONTEES D'EAU ARTIFICIELLES]**
H. Boutiere and J. Vasserot *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 11-15 In FRENCH (For availability see N73-33762 24-29)

# 14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

**N73-33361*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**HAND-HELD PHOTOMICROSCOPE Patent**
Harry R. Zabower, inventor (to NASA) Issued 9 Oct. 1973 6 p Filed 13 Sep. 1972
(NASA-Case-ARC-10468-1; US-Patent-3,764,209; US-Patent-Appl-SN-288857; US-Patent-Class-355-18; US-Patent-Class-95-12) Avail: US Patent Office CSCL 14B

A small, lightweight, compact, hand-held photomicroscope provides simultaneous viewing and photographing, with adjustable specimen illumination and exchangeable camera format. The novel photomicroscope comprises a main housing having a top plate, bottom plate, and side walls. The objective lens is mounted on the top plate in an inverted manner relative to the normal type of mounting. The specimen holder has an adjusting mechanism for adjustably moving the specimen vertically along an axis extending through the objective lens as well as transverse of the axis. The lens system serves to split the beam of light into two paths, one to the eyepiece and the other to a camera mounting. A light source is mounted on the top plate and directs light onto the specimen. A rheostat device is mounted on the top plate and coupled to the power supply for the light source so that the intensity of the light may be varied.
Official Gazette of the U.S. Patent Office

**N73-33362** Ohio State Univ., Columbus.
**ANALYSIS OF SONIC TRANSDUCERS Ph.D. Thesis**
Ching-Chiou Feng 1973 153 p
Avail: Univ. Microfilms Order No. 73-18890

Several sonic resonators and transducers which take the form of a sandwich consisting of two PZT-4 rings clamped between steel cylinders have been analyzed. Theoretical formulations employing the linear theory of piezoelectricity are obtained. The PZT-4 ceramic is modeled as a plate in thickness vibration and a thin rod in longitudinal vibration. The resonant frequencies are obtained by solving the frequency equations numerically. Experimental results show that a rise in the transducer temperature or a higher driving ac rms voltage corresponds to a lower resonant frequency. A portion of the temperature effect is related to the thermal prestress release effect. Dissert. Abstr.

**N73-33363** Ohio State Univ., Columbus.
**INVESTIGATIONS INTO THE FEASIBILITY OF EMPLOYING A HYPOTHETICAL PANORAMIC-FRAME CAMERA SYSTEM IN AERIAL TRIANGULATION Ph.D. Thesis**
Alfred Boyce Devereaux, Jr. 1973 171 p
Avail: Univ. Microfilms Order No. 73-18886

The panoramic camera is capable of producing high resolution imagery over a wide area from a compact, light weight system. Unfortunately, these advantages are offset by the effect of the dynamic motion of the camera during the relatively long exposure. The added parameters increase the number of control points required to perform the aerial resection of the cameras' position. The feasibility of using a co-mounted frame camera to generate this necessary density of control was studied. Further, the nature of the propagation of errors in the pan-frame system and the relative magnitude of these errors were determined. finally, some aspects of the effects of the nonlinearity of the model on these computations are explored. Dissert. Abstr.

**N73-33364*#** Ball Bros. Research Corp., Boulder, Colo.
**CIT PHOTOHELIOGRAPH FUNCTIONAL VERIFICATION UNIT TEST PROGRAM Final Report**
Jun. 1973 41 p
(Contract NAS8-29151)
(NASA-CR-124455; F73-04) Avail: NTIS HC $4.25 CSCL 14B

Tests of the 2/3-meter photoheliograph functional verification unit FVU were performed with the FVU installed in its Big Bear Solar Observatory vacuum chamber. Interferometric tests were run both in Newtonian (f/3.85) and Gregorian (f/50) configurations. Tests were run in both configurations with optical axis horizontal, vertical, and at 45 deg to attempt to determine any gravity effects on the system. Gravity effects, if present, were masked by scatter in the data associated with the system wavefront error of 0.16 lambda rms ( = 6328A) apparently

due to problems in the primary mirror. Tests showed that the redesigned secondary mirror assembly works well. Author

**N73-33365*#** Mechanical Technology, Inc., Latham, N.Y. Research and Development Div.
**REVIEW OF MECHANICAL VIBRATION TESTS CONDUCTED ON CONTROL MOMENT GYROS AND LIFE TEST FIXTURES**
R. F. Burchill 24 Aug. 1973 31 p ref Sponsored by NASA (MTI Proj. 0250-40077)
(NASA-CR-124449; MTI-73TR33) Avail: NTIS HC $3.75 CSCL 17G

Experimental vibration studies performed on a number of flight control moment gyros and bearing life test fixtures are summarized. Tests were performed at MSFC, at Wyle Laboratories, Huntsville, Alabama, and at the Bendix Corporation facilities in Teterboro, New Jersey. A description of test and analysis equipment is included as well as test procedures and overall performance rankings. Advanced ultrasonic rolling element bearing fault detection techniques were applied for bearing analysis along with conventional vibration and sound analysis procedures.
Author

**N73-33366#** Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
**AN INSTRUMENT FOR MEASURING STEADY AND OSCILLATORY AERODYNAMIC FORCES**
L. Stellema Nov. 1973 53 p refs
(ATN-7101) Avail: NTIS HC $4.75

An instrument to measure the steady and oscillatory aerodynamic forces on a sting-mounted model, using the forced oscillatory technique is described. The sting is oscillated in a sinusoidal motion of known amplitude and frequency. A flexible reference beam, situated outside the wind tunnel is oscillated in phase with the sting. A strain-gauge bridge bonded to the reference beam provides a phase reference signal. With the wind off, the amplified output of the strain-gauge bridge, on the reference beam, is made equal to the amplified output of the two strain-gauges bridges on the sting, by means of two attenuators. Thus the outputs from the sting amplifiers due to inertia are made zero, and when the wind is on the true oscillatory aerodynamic forces can be measured. To measure the steady state forces, the dc output of the sting due to weight is set at zero by means of a potentiometer when the wind is off. Author

**N73-33367*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**CONTROL OF CONTAMINANTS ON SENSORS. REPORT 1: INTERDIRECTORATE WORKING GROUP ON EARTH OBSERVATION SENSORS**
W. Hovis, D. Smith, A. McCulloch, I. L. Goldberg, H. Ostrow, and B. Seidenberg Oct. 1973 10 p
(NASA-TM-X-70487; X-652-73-306) Avail: NTIS HC $3.00 CSCL 14B

Examples of contamination of sensors from various sources during space missions are presented. Design precautions to provide access to optical surfaces and venting of outgassing products are recommended as methods for coping with contamination. The effects of the sensor materials on sensor contamination are analyzed. Actions to be taken during transportation, storage, and testing of sensors to avoid contamination are discussed. Author

**N73-33368#** Southwest Research Inst., San Antonio, Tex.
**AUTOMOTIVE DISC RECORDER ENVIRONMENTAL TESTS Final Report**
T. D. Dunham and D. C. Scheidt Oct. 1973 112 p refs
(Contract DOT-HS-024-3-731)
Avail: NTIS HC $7.75

The purpose of this program was to subject the Model 35500 automotive triaxial disk recorders to temperature, shock, vibration, humidity, salt-fog, and electromagnetic environments and to document the performance of the recorders prior, during, and after being exposed to these environmental conditions. Dimensional change of the stylus-to-disk clearance, any variation in recorder rotational speed, and any recorder failure during environmental testing were also considered. Author

**N73-33369#** Joint Publications Research Service, Arlington, Va.
**GYROSTABILIZED MARINE GRAVIMETER**
Ye. I. Popov, ed. 2 Oct. 1973 87 p refs Transl. into ENGLISH from the book "Morskoy Girostabilizirovannyy Gravimeter' Moscow, Izdatelstvo Nauka, 1972
(JPRS-60183) Avail: NTIS HC $6.50

Articles are given on the design, tests and use of gyrostabilized marine gravimeters. The design of its sensing element an elastic system, and three modifications of the instrument differing in the design of the reading device are presented. Results of laboratory tests are also included. Author

**N73-33370#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**METHOD OF DIMINISHING THE INFLUENCE OF INTERFERENCE ON THE OPERATION OF A CORRELATION INTERFEROMETER**
A. T. Gavrilin and A. A. Gorbachev [1973] 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), v. 16, no. 7, 1973 p 1040-1044
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The method of attenuating the influence of FM interference on the result of noisy signal reception by using a two channel correlometer is investigated. The method consists of inserting an envelope detector with a series connected high frequency filter in each of the correlometer channels. An estimate is made of the effect of interference suppression. Author

**N73-33371*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**THE DEVELOPMENT OF A TWO-COMPONENT FORCE DYNAMOMETER AND TOOL CONTROL SYSTEM FOR DYNAMIC MACHINE TOOL RESEARCH**
Ian Alexander Sutherland 23 May 1973 47 p refs
(NASA-TM-X-64786) Avail: NTIS HC $4.50 CSCL 14B

The development is presented of a tooling system that makes a controlled sinusoidal oscillation simulating a dynamic chip removal condition. It also measures the machining forces in two mutually perpendicular directions without any cross sensitivity.
Author

**N73-33372#** Joint Publications Research Service, Arlington, Va.
**OPTO-ELECTRONIC INSTRUMENTS FOR SPACECRAFT, PART 1**
A. N. Iznar, A. V. Pavlov, and B. F. Federov 4 Oct. 1973 175 p Transl. into ENGLISH of the book "Optiko-Elektronnyye Pribory Kosmicheskikh Apparatov" Moscow, Izdatelstvo Mashinostroyeniye, 1972 368 p
(JPRS-60199-1-Pt-1) Avail: NTIS HC $10.75

Theoretical principles are discussed for the planning and designing of opto-electronic orientation and navigation instruments. The construction principles and the standard schematics for opto-electronic instruments for different purposes are given. Methods of calculating the parameters are presented which take into account the radiation attenuation in the atmosphere and the background effect and also the peculiarities of calculating the basic parameters of equipment with lasers. Methods of calculating the radiation characteristics of the sources are also given. Author

**N73-33373#** Joint Publications Research Service, Arlington, Va.
**OPTO-ELECTRONIC INSTRUMENTS FOR SPACECRAFT, PART 2**
A. N. Iznar, A. V. Pavlov, and B. F. Federov 4 Oct. 1973 213 p refs Transl. into ENGLISH from the book "Optiko-Elektron. Pribory Kosmich. App." Moscow, Izd. Mashinostr., 1972 368 p
(JPRS-60199-2-Pt-2) Avail: NTIS HC $12.75
For abstract, see N73-33372

**N73-33374#** Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
**SENSITIVITY OF GRAVITATIONAL DETECTOR WITH PASSIVE TRANSDUCER**

V. B. Braginskii and V. N. Rudenko 1972 13 p refs In ENGLISH; RUSSIAN summary
(ITF-72-90-E) Avail: AEC Depository Libraries HC $3.00

The different gravitational antennas with passive electromechanical transducers were analyzed in the domain of reception of short radiation pulses. The case of coincidence of the electrical and mechanical partial frequencies is discussed. It is shown that the optimal electromechanical coupling in the case of large difference of relaxation times provides sensitivity times worse than the potential sensitivity of a gravitational detector.
Author (NSA)

**N73-33375#** California Univ., Berkeley. Lawrence Berkeley Lab.
**WAVELENGTH MODULATION SPECTROSCOPY OF SOME SEMICONDUCTORS AND METALS Ph.D. Thesis**
J. A. Stokes Mar. 1973 109 p refs
(Contract W-7405-eng-48)
(LBL-1125) Avail: NTIS HC $7.50

The derivative reflectivity spectra measured at 5 deg, 77 deg and 300 K for the noble metals (Cu, Ag, Au) and for two III-V semiconductors (GaP, InP) are presented and discussed. The results are interpreted with the help of pseudopotential band structure calculations. The data for GaP and InP are compared with previous measurements on the other III-V compounds. Taking advantage of the sensitivity of the wavelength modulation technique, the derivative reflectivity of GaAs in the e sub 0 region was obtained for uniaxial stresses up to 8 kbars in the (111) direction and up to 9 kbars in the (001) direction. A theoretical treatment of the effects of stress perturbation was used to interpret the experimental curves. It was found that the dominant structure in the e sub 0 region arises from delta v sub 5 yields delta c sub 5 transitions. Author

**N73-33376#** Sandia Labs., Albuquerque, N.Mex.
**HOLOGRAPHIC MEASUREMENTS OF THE PLASMAS IN A HIGH-CURRENT FIELD EMISSION DIODE**
L. P. Mix, J. G. Kelly, G. W. Kuswa, D. W. Swain, and J. N. Olsen 1973 14 p refs Presented at 12th Symp. on Electron, Ion, and Laser Beam Technol., Cambridge, Mass., 21 May 1973
(SLA-73-5483; Conf-730529-3) Avail: NTIS HC $3.00

Two exposure holographic interferometry was used to obtain the first quantitative measurements of the plasma densities in an intense electron beam diode. Several diode configurations which produce an intense pinch of the electron beam at the anode plane were investigated. Holograms indicating the temporal and spatial evolution of the plasmas in these diodes are presented. Two types of plasmas are observed in these diodes: a lower density plasma with a velocity of 5 to 10 cm/microsec and a higher density plasma with a velocity of about 2 cm/microsec. Preliminary analysis indicates that the lower density plasma plays a dominant role in determining the primary beam dynamics. Author (NSA)

**N73-33377#** Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
**ATTITUDE GYROS FOR STABILIZATION OF COMMUNICATION SATELLITES [STELLKREISEL FUER DIE STABILISIERUNG VON NACHRICHTENSATELLITEN]**
Heinz Wehde and Wolfram Asprion 1973 25 p In GERMAN Presented at the DGLR Symp. Nachrichtensateliten, Stuttgart, 16-17 May 1973
(DGLR-Paper-73-058) Avail: NTIS HC $3.25

A survey was made of attitude gyros for communication satellites with particular attention paid to the gyro used in the Symphonie satellite. This type employs a reaction wheel. The gyro rotor produces a spin of nominally 20 Nms, which can be varied 10% upwards and downwards to produce the reaction moments necessary for attitude control. Technical problems such as lubrication are discussed, and some designs presented.
ESRO

**N73-33378#** Toulouse Univ. (France). Lab. de Genie Electrique.
**PREQUALIFICATION TESTS OF MATERIALS TO BE USED FOR THE COATING OF CHANNEL MULTIPLIERS Final Report [SUR LES ESSAIS DE PREQUALIFICATION DU PRODUIT DESTINE A L'ENROBAGE DE MULTIPLICATEURS TUBULAIRES D'ELECTRONS]**
Pham VanVui 29 Feb. 1972 16 p refs In FRENCH Prepared for Centre d'Etude Spatiale des Rayonnements
Avail: NTIS

The properties of a titanium dioxide doped silicon rubber potting compounds for satellite-borne channel multipliers is presented. The dielectric rigidity, superficial and transversal resistivity, modulus of elasticity, weight loss under vacuum, and water absorption are discussed, and numerical data are given. Outgassing influence on the channel multiplier characteristics with regard to gain factor time history as a function of integrated counts up to 50 million counts was experimentally tested showing a limited perturbation due to the elastomer presence. Two examples of space applications are given: for auroral zone particle detection using Bendix 4013 funnel type channels and for interstellar space helium density measurement using a Bendix 3029X helicoidal channnel. Potting procedures and performance test results are given. ESRO

**N73-33379#** Toulouse Univ. (France). Lab. de Genie Electrique.
**USE OF CHARGED SILICONE RUBBER FOR THE COATING OF ONBOARD CHANNEL MULTIPLIERS [UTILISATION D'UN ELASTOMERE SILICONE CHARGE POUR L'ENROBAGE DE MULTIPLICATEURS TUBULAIRES D'ELECTRONS EMBARQUES]**
Pham VanVui, C. Barat, M. Dennefeld (Paris Univ.), and M. Guyader [1972] 14 p refs In FRENCH; ENGLISH summary
Avail: NTIS HC $3.00

The properties of a titanium dioxide silicon rubber potting compound for satellite-borne channel multipliers is presented. The dielectric rigidity, superficial and transversal resistivity, modulus of elasticity, weight loss under vacuum, and water absorption, are discussed, and numerical data given. Outgassing influence on the channel multiplier characteristics with regards to gain factor time history as a function of integrated counts up to 50 million counts was experimentally tested showing a limited perturbation due to the elastomer presence. Two examples of space applications are given: for auroral zone particle detection using BENDIX 4013 funnel type channels and for interstellar space helium density measurement using a BENDIX 3029X helicoidal channel. Potting procedures and performance test results are given. ESRO

**N73-33380#** Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
**TWO-METER PATH DIFFERENCE INTERFEROMETER FOR FOURIER SPECTROSCOPY**
James Pritchard, Hajime Sakai, and George Vanasse 11 Apr. 1973 33 p refs
(AF Proj. 8603)
(AD-764719; AFCRL-TR-73-0223) Avail: NTIS CSCL 07/4

This is an interim report on the progress in the development of a high-resolving power interferometer to be used for line shape measurements. An interferometer is described in detail, as well as the data handling and processing schemes used. A resolution of 0.06/cm was obtained with the instrument operating out in the open with little concern for vibration isolation. Test results are included. (Modified author abstract) GRA

**N73-33381#** Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
**AN INVESTIGATION OF AIRBORNE DISPLAYS AND CONTROLS FOR SEARCH AND RESCUE (SAR). VOLUME 7: NAVY COMBAT SAR AVIONICS CAPABILITY STUDY (1972 - 1974 ERA) Final Report, Jun. 1972 - Jan. 1973**
A. L. Jones and James W. Wingert Feb. 1973 53 p refs
(Contract N00014-69-C-0460; NR Proj. 213-072)
(AD-764914; HONEYWELL-12609-FR1-Vol-7; JANAIR-730702-Vol-7) Avail: NTIS CSCL 06/7

The report presents results of a study to assess the avionics capability of the present generation Navy combat search and rescue helicopters (HH-3A's). The study used interviews of experienced combat SAR pilots. Analyses were performed to evaluate the baseline HH-3A avionics and presently available avionic equipments against various search and environmental

conditions. The most cost-effective improvement to the present HH-3A avionic capability for search and rescue was found to be Night-Vision Goggles for the pilot and a crew member.
Author (GRA)

**N73-33382#** Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
**TEXTURE TONE STUDY. CATEGORY MAPS, GRADIENT AND HOMOGENEITY IMAGES Interim Technical Report**
Robert M. Haralick and ItsHak Dinstein May 1973 24 p refs (Contract DAAK02-70-C-0388; DA Proj. 4A6-62707-D-853) (AD-765526; CRES-TR-182-5; ITR-5) Avail: NTIS CSCL 14/5

Two scenes were selected from 1:20,000 aerial photographs in order to demonstrate generation of category maps and gradient and homogeneity images. The category maps generation used a MINMAX decision rule to identify three categories in each one of the scenes. Gradient and homogeneity images were generated using the JDATA programs. All the results were displayed on the IDECS colored monitor. Photographs of the results are provided in the report. Author (GRA)

**N73-32952*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**HEAD-UP DISPLAYS FOR STOL VISUAL APPROACHES**
Everett A. Palmer and Fred W. Cronn (San Jose State Univ.) *In its* STOL Technol. 1972 p 227-243 refs (For availability see N73-32934 24-02)
CSCL 01D

**N73-33840*** Colorado Univ., Boulder.
**ULTRAVIOLET SPECTROMETER EXPERIMENT**
C. A. Barth, C. W. Hord, A. I. Stewart, and A. L. Lane (JPL) *In* JPL Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 53-61 refs (For availability see N73-33834 24-31) .
CSCL 14B

# 15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

**N73-33383*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**PRODUCTION OF HOLLOW COMPONENTS FOR ROLLING ELEMENT BEARINGS BY DIFFUSION WELDING Patent**
Thomas J. Moore, inventor (to NASA) Issued 31 Jul. 1973 5 p Filed 9 Nov. 1971 Supersedes N72-15472 (10 - 06, p 0778)
(NASA-Case-LEW-11026-1; US-Patent-3,748,722; US-Patent-Appl-SN-196970; US-Patent-Class-29-487; US-Patent-Class-29-494; US-Patent-Class-29-497.5; US-Patent-Class-29-498) Avail: US Patent Office CSCL 13I

A hollow rolling element for a bearing is fabricated by diffusion welding hollow shells together. The hollow shell halves are joined by faying surfaces and diffusion welding.
Official Gazette of the U.S. Patent Office

**N73-33384** Purdue Univ., Lafayette, Ind.
**AN EXPERIMENTAL AND THEORETICAL INVESTIGATION TECHNIQUE FOR A LINEARLY OSCILLATING ELECTRO-MAGNETIC PUMP Ph.D. Thesis**
Martin James Stevenson 1972 158 p
Avail: Univ. Microfilms Order No. 73-15873

The electromagnetic pump studied is a magnetically polarized solenoid in which the armature carries a moving valve. The objective of the study is to predict, to within design accuracy, the performance characteristics of the pump. First, the four sub-systems (electrical, magnetic, mechanical and fluid) are modelled in terms of lumped parameters. Then the dynamic equations of motion for the complete system are derived using Lagrange's equation. A first order ordinary differential equation in the exciting current and a second order ordinary differential equation in the piston motion result. These two equations are nonlinearly coupled. By assuming a sinusoidal current, a biased sinusoidal piston motion and a halfwave rectified sinusoidal fluid velocity, and using Galerkin approximate solution technique, the dynamic equations are converted to algebraic equations in the assumed amplitudes and phases. Frequency response predictions are obtained by numerically solving these algebraic equations at many different frequencies. Dissert. Abstr.

**N73-33385** Clemson Univ., S.C.
**A GENERAL MONTE CARLO SIMULATION MODEL FOR ESTIMATING LARGE SCALE SYSTEM RELIABILITY AND AVAILABILITY Ph.D. Thesis**
Kingsley Ellis Forry 1972 239 p
Avail: Univ. Microfilms Order No. 73-19264

Estimation of the reliability and availability of large complex systems through application of the Monte Carlo technique is described. The basic Monte Carlo methodology was applied to simulate the failure times of system components from their time to failure probability distributions. From these, formulas were developed to compute the time to failure of important subsystems of components. For exponentially failing standby subsystems, procedures included consideration of switching mechanism failure and component shelf failure. A procedure was then developed to compute the lifetime of serial or non-serial systems. Monte Carlo procedures were also developed to simulate the repair time for a failed system. The Monte Carlo procedures developed to simulate component, subsystem, and system failure and repair times and the statistical methods used to compute system reliability and availability estimates were combined into a general reliability/ availability simulator computer program. The program computes maximum likelihood, minimum variance, and unbiased point estimates and one-sided lower confidence limit estimates of system reliability. Dissert. Abstr.

**N73-33386#** Cranfield Inst. of Technology (England).
**ELECTRODE BURN OFF CHARACTERISTICS OF MANUAL METAL ARC ELECTRODES USING CONTINUOUS AND MODULATED WELDING CURRENT**
B. E. Pinfold and R. L. Apps Apr. 1973 34 p refs (Cranfield-Mat-9) Avail: NTIS HC $3.75

The use of continuous current in the range 30-120 amperes with Class 2 10SWG (3.2mm) electrodes produces a near linear relationship between welding current and electric burn off rate. A comparison of modulated and continuous current welding reveals that virtually identical burn off curves are produced provided average current is taken as the basis for equivalence. This shows that for a given electrode type and size, operating at a particular voltage, burn off rate is entirely dependent on average current. Because of this fact the low current period in pulsed manual metal arc welding is of greater significance than for other modulated current processes. The minimum current level necessary to maintain a stable arc for a 10SWG electrode during the low current period is approximately 50 amperes. This level of current makes a substantial contribution to the total average current, especially if the ratio of the low to high current period is greater than unity. Author

**N73-33387#** Central Electricity Generating Board, London (England).
**THE WEIBULL DISTRIBUTION, 1957 - 1972**
I. Riseman Aug. 1973 27 p refs
(CE-Bib-235) Avail: NTIS HC $3.50

A Weibull distribution bibliography and related materials are presented. Studies relating to reliability are given along with failure, life-testing, fatigue, preventative maintenance, and planned replacement. T.M.R.

**N73-33388*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**GEAR MATERIALS FOR HIGH-PRODUCTION LIGHT-DEPUTY SERVICE**
Dennis P. Townsend 1973 7 p Presented at the Power Transmission Design Show, Chicago, 9-10 Oct. 1973
(NASA-TM-X-71446; E-7684) Avail: NTIS HC $3.00 CSCL 13I

The selection of a material for high volume, low cost gears

requires careful consideration of all the requirements and the processes used to manufacture the gears. The wrong choice in material selection could very well mean the difference between success and failure. A summary of the cost that might be expected for different materials and processes is presented; it can be seen that the cost can span nearly three order of magnitudes from the molded plastic gear to the machined gear with stamped and powder metal gears falling in between these extremes. Author

**N73-33389*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ROLLING-ELEMENT BEARINGS: A REVIEW OF THE STATE OF THE ART**
William J. Anderson and Erwin V. Zaretsky 1973 86 p refs Presented at Tribology Workshop, Atlanta, 19-20 Oct. 1973, sponsored by NSF
(NASA-TM-X-71441; E-7697) Avail: NTIS HC $6.50 CSCL 13I

Some of the research conducted which has brought rolling-element technology to its present state is discussed. Areas touched upon are material effects, processing variables, operating variables, design optimization, lubricant effects and lubrication methods. Finally, problem areas are discussed in relation to the present state-of-the-art and anticipated requirements. Author

**N73-33390*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**THE ATOMIC NATURE OF POLYMER-METAL INTERACTIONS IN ADHESION, FRICTION AND WEAR**
Donald H. Buckley and William A. Brainard [1973] 18 p refs Proposed for presentation at the Symp. on Advan. in Polymer Friction and Wear, Los Angeles, 31 Mar. - 4 Apr. 1974; sponsored by Am. Chem. Soc.
(NASA-TM-X-71452; E-7727) Avail: NTIS HC $3.00 CSCL 07D

Adhesion experiments with polytetra-fluoroethylene (PTFE) and polyimide contacting tungsten indicate that the polymers bond chemically to the clean metal surface. Polymer chain fragments which transfer to the surface of tungsten in field ion microscopy adhesion studies are highly oriented. Auger emission spectroscopy of PTFE transfer films to various metal surfaces indicates that the PTFE is bonded to the metal surface via the carbon atom. With PTFE in sliding contact with different orientations of aluminum, metal orientation is found to influence surfaces in sliding. The lowest friction and least amount of surface damage is detected on the highest atomic density (111) plane. The friction process itself can initiate polymer film formation from simple organic molecules. Author

**N73-33391*#** Linguistic Systems, Inc., Cambridge, Mass.
**EVOLUTION OF COEFFICIENT OF FRICTION, RESISTANCE OF CONTACT AND WEAR FOR A PIN ON DISK FRICTION PAIR**
Ivan Iliuc Washington NASA Oct. 1973 22 p refs Transl. into ENGLISH from Erodel und Kohl (West Germany), v. 26, no. 1, Jan. 1973 p 31-37
(Contract NASw-2482)
(NASA-TT-F-15049) Avail: NTIS HC $3.25 CSCL 20K

The study of friction processes in a lubricated pin on disk friction pair are discussed. The dependence of the coefficient of friction mu and of the mean electric resistance of contact bar W on eta UR/P parameter shows the existence of hydrodynamic or mixed lubrication function value of the parameter. Although the loaded surfaces are nominally parallel, the required angle for maximum carrying capacity is so small that it appears as a result of the running-in process and of the unavoidable clearance and elasticity of the fixing device of the pin. In order to study the effect of different additives, a mixed lubrication at low speed was realized. It was found that dibenzyl mu disulphide has no influence on mu and bar W, oleic acid reduces mu but maintains unmodified bar W and Zn-dithiophosphate reduces mu and increases bar W. In the last case the reaction layer formed on the surface affects bar W, but in static and dynamic conditions. Author

**N73-33392*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**PLASMA-SPRAYED METAL-GLASS AND METAL-GLASS FLUORIDE COATINGS FOR LUBRICATION TO 900 C**
Harold E. Sliney [1973] 26 p refs Proposed for presentation at Ann. Meeting of the Am. Soc. of Lubrication Engr., Cleveland, 29 Apr. - 2 May 1974
(NASA-TM-X-71432; E-7574) Avail: NTIS HC $3.50 CSCL 11H

Plasma-sprayed composites, which have good oxidation-resistance and self-lubricating characteritics to 900 C, were developed. The composites are a nichrome matrix containing dispersed glass for oxidation protection and calcium fluoride for lubrication; they are applied to bearing surfaces by plasma spraying layers about 0.050 centimeters thick which are then machined to 0.025 centimeters. Oscillating bearing tests were performed in air to 900 C at unit radial loads up to 3.5 x 10 to the 7th power N/sq M (5000 psi) and a thrust load of 1960N (440 lbs). Bearings with a composite liner in the bore were in good condition after over 50,000 oscillating cycles accumulated during repeated, bearing temperatures cycles between 25 and 900 C. Author

**N73-33393#** Sandia Labs., Albuquerque, N.Mex.
**FEASIBILITY STUDY ON FAST-ACTING VALVES FOR AIRBORNE NUCLEAR CONTAINMENT SYSTEMS**
W. F. Scott Jun. 1973 33 p Sponsored by AEC
(AFWL Proj. 73-093)
(SLA-73-221) Avail: NTIS HC $3.00

The feasibility of developing fast-acting valves to seal the coolant lines emanating from a reactor used to power aircraft was studied. The valves must be made integral with the wall of a hardened containment sphere in such a way that the structural integrity of the sphere is unimpaired in the event of a crash. Author (NSA)

**N73-33394#** Los Alamos Scientific Lab., N.Mex.
**RECOMMENDED USE OF SI UNITS IN THE NUCLEAR ROCKET ENGINE PROGRAM**
R. J. Bohl May 1973 26 p refs
(Contract W-7405-eng-36)
(LA-5285-MS) Avail: NTIS HC $4.00

Basic technical information is given for using the international system of units (SI) that has been adopted recently for reporting all Nuclear Rocket Engine Program technical work. Special problems are discussed and some modifications to the SI system are introduced, which are dictated by the special needs of the Nuclear Rocket Engine Program. Some background of the SI system and the considerations that led to its adoption for the Nuclear Rocket Engine Program are also reviewed. Author (NSA)

**N73-33395#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.
**TECHNIQUES OF ELECTROFORMING AND THEIR APPLICATION IN MANUFACTURING MODELS FOR HYPERSONIC EXPERIMENTS**
D. Rammenzweig and G. Rohde 1973 43 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-40; AVA-FB-7302) Avail: NTIS HC $4.25; DFVLR, Porz, West Ger. 13,50 DM

The different steps in the process of electroforming of hollow wind tunnel models, the necessary equipment, and the preparation of materials for the performance tests are discussed. The wind tunnel models are non-developable, vacuum tight, and thin walled bodies for high thermal loads. Contrary to normal forming which is based on the manufacture of multiple positives, negative models are dealt with. The manufacture of double-walled cooled hollow wind tunnel nozzles is also discussed. The models and nozzles were produced from pure nickel due to several special properties of this material. Several types of electrolytes are described with regard to their application. ESRO

**N73-33396#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**EXPERIMENTAL STUDY OF THE SPRAYING OF POWDER COATINGS ONTO BODIES OF COMPLEX CONFIGURATION**
I. P. Vereshchagin, G. M. Ananyasvili, and S. Dogadin 30 Jul. 1973 11 p Transl. into ENGLISH from the publ. "Tekhnika

Vysokikh Napryazheniy" USSR, 1972 p 115-118
(AD-764933; FTD-HT-23-795-73) Avail: NTIS CSCL 13/8

The translation concerns methods of insulating grooves in micromachines. An experiment is described which involves spraying a powdered polymer in combination with an electric field. The distance between electrodes, voltage, current, temperature, flow rate, and moisture content of the air, and spraying time were monitored. Results are reported. GRA

**N73-33494*** McDonnell-Douglas Astronautics Co., St. Louis, Mo.
**MECHANICAL ATTACHMENT OF REUSABLE SURFACE INSULATION TO SPACE SHUTTLE PRIMARY STRUCTURE**
R. W. Fleck and J. K. Lehman *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1029-1061 (For availability see N73-33490 24-18) CSCL 13H

# 16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

**N73-33397*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**ALIGNMENT APPARATUS USING A LASER HAVING A GRAVITATIONALLY SENSITIVE CAVITY REFLECTOR Patent**
Kenneth W. Billman and Eugene T. Leonard, inventors (to NASA) Issued 9 Oct. 1973 8 p Filed 30 Jul. 1971
(NASA-Case-ARC-10444-1; US-Patent-3,764,220; US-Patent-Appl-SN-167719; US-Patent-Class-356-153; US-Patent-Class-356-138; US-Patent-Class-331-94.5A; US-Patent-Class-356-148; US-Patent-Class-356-172; US-Patent-Class-350-285) Avail: US Patent Office CSCL 20E

A description is given of a device for determining a true gravitational vertical. The apparatus is composed of a vertically disposed laser with a gravitationally sensitive lower regeneration reflector. The reflector enables an output beam to be developed only when the optical axis of the laser is disposed normal to the gravitationally sensitive reflective surface. In an alternative embodiment, the devices is combined with a servo system to provide a gravitationally stabilized horizontal platform.
Official Gazette of the U.S. Patent Office

**N73-33398** Maryland Univ., College Park.
**EFFICIENT OPTICALLY COUPLED GaAl GaAlAs DIODE PUMPED Nd:YAG LASER Ph.D. Thesis**
Ying Chao Kiang 1972 106 p
Avail: Univ. Microfilms Order No. 73-18249

An index matching method to increase the coupling efficiency of a GaAlAs diode pumped Nd:YAG laser is described. A solid glass half cylinder of 5.0 cm diameter by 5.6 cm long was used for index matching and also as a pumping cavity reflector. The laser rods were 1.5 mm diameter by 56 mm long with dielectric coatings on both end surfaces. The interfaces between the diode array, glass cylinder, and laser rod were filled with Lens Bond of refractive index n = 1.55. Experiments performed with both the glass cylinder and a gold coated stainless steel reflector under the same operating conditions indicated that the index matching cylinder gage 159% to 199.5% improvement of coupling efficiency over the metal reflector at various operating temperatures. The dynamic and static behavior of the Nd:YAG laser was analyzed using the nonlinear rate equations. The laser threshold, optimum power output and amplitude modulation by pumping intensity variation were evaluated and compared with experimental results. Dissert. Abstr.

**N73-33399** Cornell Univ., Ithaca, N.Y.
**LASER-INDUCED ATOM EXCHANGE Ph.D. Thesis**
David M. Lederman 1973 96 p
Avail: Univ. Microfilms Order No. 73-18349

A direct experimental technique is developed here to investigate a vibrational excitation mechanism for the homogeneous exchange reaction H2 plus D2 yields HD plus HD which was proposed as a consequence of experimental results obtained in previous studies of this reaction employing single pulse shock tube techniques. This mechanism is based on the assumption that the rate of atom exchange is controlled by the rate of excitation of the hydrogen (or deuterium) to a critical vibrational level from which exchange occurs very rapidly. Stated differently, in the suggested mechanism, the collision cross section for exchange is much higher when the activation energy comes from energy stored in vibrational degrees of freedom than in the case when the available energy is in the form of relative translational kinetic energy. Dissert. Abstr.

**N73-33400** Brigham Young Univ., Provo, Utah.
**REACTIONS OF N2F4 AND SF6 WITH H2 INDUCED BY CO2 LASER PULSES AND BY ELECTRICAL DISCHARGE Ph.D. Thesis**
John Leslie Lyman 1973 190 p
Avail: Univ. Microfilms Order No. 73-18229

A high power pulsed CO2 laser was used to induce reactions in gas mixtures containing either N2F4 or SF6. The rate of laser induced dissociation of N2F4 to NF2 was as much as 1000 times faster than the thermal rate, and the rate law was of lower order than the thermal, bimolecular rate law. Explosion threshold and induction time data were obtained for butene stabilized mixtures of N2F4 and H2. HF laser gain was observed during the first few microseconds of CO2 laser pulse, but it was strongly quenched by the explosion. The laser driven reaction of SF6 with H2 also exhibited HF laser gain at early times and laser energy threshold for reaction. All of the laser induced reactions studied occurred at rates that were faster than the rates of thermal reaction. This accelerated reaction rate was attributed to nonthermal vibrational excitation of the reactants.
Dissert. Abstr.

**N73-33401#** Chalmers Univ. of Technology, Goteborg (Sweden).
**ON MASER AMPLIFICATION OF INCOHERENT RADIATION, PART 1**
Bengt Isaksson May 1973 103 p refs
(RR-113-Pt-1) Avail: NTIS HC $7.25

Traveling wave amplification of incoherent radiation by a maser (or laser) was studied with emphasis on the statistical properties of the electromagnetic field under the influence of the nonlinearities of the amplifier. Semiclassical approximations, and statistical description of the radiation fields are derived, and the spatial amplification of stationary electromagnetic fields is discussed along with the time dependence of the correlations between the intensity fluctuations. The effect of propagation properties on the statistical field properties are also discussed.
F.O.S.

**N73-33402#** Chalmers Univ. of Technology, Goteborg (Sweden).
**HEAT TREATED CHROMIUM DOPED RUTILE USED IN AN L-BAND TRAVELING WAVE MASER**
P. O. Andersson Nov. 1972 32 p
(RR-111) Avail: NTIS HC $3.75

The net gain of a traveling wave maser operating at 4.2 K in the frequency range 1680-1950 MHz has been improved by heat treatment of the active material, chromium doped rutile (Cr-TiO2). The heat treatments investigated, diffusion doping, quenching, and annealing were performed in a nearly hydrogen-free atmosphere of oxygen at 1200 C. The maximum net gain with a 3-db bandwidth of 6 MHz was 35 db at 4.2 K and 1800 MHz. The length of the slow wave structure was 55 mm. The net gain per unit length is the highest hitherto obtained.
Author

**N73-33403#** Defence Research Establishment Valcartier (Quebec).
**PRESSURE DEPENDENT ABSORPTION IN BCL3 AT 10.6 MICRON**
P. Lavigne and J. L. Lachambre Aug. 1973 10 p refs
(DREV-TN-2086/73) Avail: NTIS HC $3.00

The absorption of 26 lines of a CO2 laser by BCl3 has been measured over a wide range of pressures. At low pressures saturation effects occurred for powers as low as 200 milliwatts/

sq cm. Above 1 torr, the absorption coefficient is found to increase linearly with pressure. A theoretical model was formulated to interpret these results. Author

**N73-33404*#** Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
**APPLICATIONS OF LASER RANGING AND VLBI OBSERVATIONS FOR SELENODETIC CONTROL Interim Report**
Francis A. Fajemirokun Nov. 1971 243 p refs
(Contract NAS9-9695; OSURF Proj. 2841)
(NASA-CR-135774; IR-6; Rept-157) Avail: NTIS HC $14.25 CSCL 20E

The observation equations necessary to utilize lunar laser ranging and very long baseline interferometry measurements were developed for the establishment of a primary control network on the moon. The network consists of coordinates of moon points in the selenodetic Cartesian coordinate system, which is fixed to the lunar body, oriented along the three principal axes of inertia of the moon, and centered at the lunar center of mass. The observation equations derived are based on a general model in which the unknown parameters included: the selenodetic Cartesian coordinates, the geocentric coordinates of earth stations, parameters of the orientation of the selenodetic coordinate system with respect to a fixed celestial system, the parameters of the orientation of the average terrestrial coordinate system with respect to a fixed celestial coordinate system, and the geocentric coordinates of the center of mass of the moon, given by a lunar ephemeris. Author

**N73-33405#** Joint Publications Research Service, Arlington, Va.
**NUCLEAR PUMPING IN MOLECULAR GAS LASERS**
V. M. Andriyakhin, V. V. Vasiltsoy, S. S. Krasilnikov, and V. D. Pismennyy 10 Oct. 1973 21 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 63, no. 5 (11), 1972 p 1635-1644
(JPRS-60244) Avail: NTIS HC $3.25

The mechanism of the populating of vibrational levels of molecules by electrons produced during the ionization of a gas by the products of nuclear reactions or by a beam of charged particles is examined. It is demonstrated that the mode, which contains the lowest excited level of a molecule, is highly populated by a diffuse stream of electrons arising in the energy space, due to the large negative gradient in the distribution of electrons by energies at the excitation of this level. Criteria for accomplishing population inversion during nuclear pumping are established, and it is shown that mixtures based on CO2 do not satisfy these criteria. Author

**N73-33406#** Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
**OPTIMUM RECEIVER AND PERFORMANCE FOR A PULSED ANGLE MODULATED OPTICAL COMMUNICATION SYSTEM M.S. Thesis**
Kohei Yamada Dec. 1972 65 p refs
Avail: NTIS HC $5.25

The optimum receiver for detection of angle modulated pulse train was analyzed in terms of maximum posteriori estimation. Although the signal spectrum contains many harmonics, the optimum receiver is a phase locked loop which operates on only the fundamental spectrum component. A suboptimum receiver which takes into account the practical hardware limitation was also analyzed. Author

**N73-33407#** Sandia Labs., Albuquerque, N.Mex. Exploratory Instrumentation Development Div.
**VARIATIONS IN THE BEAM CHARACTERISTICS OF A LIDAR SYSTEM**
M. J. Landry May 1973 65 p refs Sponsored by AEC
(SLA-73-347) Avail: NTIS HC $5.25

Variations in four beam characteristics of the high repetition rate, giant pulse, ruby laser used in the GB-60B lidar system were investigated as functions of five laser controllable parameters. Beam characteristics investigated included divergence, intensity distribution, directivity, and consistency of output energy. Variations in the laser beam characteristics were monitored as functions of ruby rod temperature, ruby rod quality, pumping repetition rate, cavity loss, and pumping energy. Resulting requirements on the pumping repetition rate in order to obtain minimums in laser beam divergence and deviation in the laser output energy were mutually exclusive. These results indicate that a laser oscillator-amplifier system with automatically controllable cavity mirrors would give more consistency in the output energy and intensity distribution than the laser oscillator presently used in lidar systems. Author (NSA)

**N73-33408#** California Univ., Livermore. Lawrence Livermore Lab.
**LASER-FUSION PROGRAM Semiannual Report, Jul. - Dec. 1972**
S. S. Sussman, ed., W. Clements, ed., and G. Shaw, ed. 9 Feb. 1973 157 p refs
(Contract W-7405-eng-48)
(UCRL-50021-72-2) Avail: NTIS HC $7.60

Research progress is described for each of the following areas: (1) solid-state lasers, (2) gas lasers, (3) component development, (4) diagnostics, (5) design analysis, (6) basic studies and advanced concepts, (7) laser plasmas, and (8) laser fusion. NSA

**N73-33409#** California Univ., Livermore. Lawrence Livermore Lab.
**KINETIC PROCESSES IN A PHOTOCHEMICAL IODINE LASER**
K. Hohla and K. L. Kompa 1972 25 p refs Transl. into ENGLISH from Z. Naturforsch. (West Germany), v. 27a, No. 5, May 1972 p 938-947
(UCRL-Trans-10692) Avail: NTIS HC $3.25

Time dependent gain measurements of a pulsed iodine laser amplifier were used to determine decay rates of excited iodine atoms 5 2P1/2. Rate constants are reported for the iodine deactivation by CF3I and C2F6. Attempts to correlate the results with predictions from a kinetic model indicate that excited iodine atoms are formed not only in the primary photolysis but also by additional chemical processes. Author

**N73-33410#** California Univ., Livermore. Lawrence Livermore Lab.
**LLL LASER PROJECT REPORT NO. 4**
G. I. Kachen, ed., S. S. Sussman, ed., and W. Clements, ed. Mar. 1973 35 p refs
(Contract W-7405-eng-48)
(UCRL-50022-4) Avail: NTIS HC $3.75

Ten reprints from LLL reports are included. These deal mainly with development of the laser with some applications to plasma physics. NSA

**N73-33411#** Commissariat a l'Energie Atomique, Limeil-Brevannes (France). Centre d'Etudes Nucleaires.
**SCATTERING OF LASER LIGHT BY THE PLASMA FOCUS OF A COAXIAL GUN**
J. P. Garconnet Jun. 1973 81 p refs In FRENCH
(CEA-R-4430) Avail: AEC Depository Libraries HC $6.25

An experimental device is presented that allows one to determine the parameters of a pulsed plasma from the forward scattering of a ruby laser beam. The results predicted by Salpeter's theory are used to evaluate the ion temperature of the plasma focus during neutron emission. Under specified conditions, the broadening of the scattered light depends on the ion temperature through the ion velocity (Doppler shift). The experimental profile of the scattered line is recorded by a 12-channel spectrometer. It is then compared to theoretical profiles. An ion temperature is derived from this comparison. Author (NSA)

**N73-33412#** Sandia Labs., Albuquerque, N.Mex.
**A 1730 A LASER TERMINATING ON A DISSOCIATING LEVEL**
A. Wayne Johnson and J. B. Gerardo [1973] 4 p refs Presented at 11th Intern. Conf. on Phenomena in Ionized Gases, Prague, 10 Sep. 1972 Sponsored by AEC
(SLA-73-5285; Conf-730906-4) Avail: NTIS HC $3.00

A laser is described in which the upper energy level of the laser transition is formed from the lowest bound diatomic states of xenon and the lower energy level is the repulse ground state. Since the lower energy level of the laser transition is not bound,

population inversion is guaranteed. However, net optical gain requires that the cross section for stimulated emission be larger than the photoionization cross sections of the upper energy laser level. Net optical gain was measured at wavelengths near 1730 A and the results are presented. Author

**N73-33413#** Institute for Advanced Study, Princeton, N.J.
**LASER FUSION AND PARAMETRIC INSTABILITES**
M. N. Rosenbluth and R. Z. Sagdeev 1973 15 p refs
(Contract AT(11-1)-3237)
(COO-3227-18) Avail: NTIS HC $3.00

Some plasma physics problems that determine the effective coupling between the laser and plasma are examined. These include parametric instabilities. A possible saturation mechanism for the backscatter into plasmons is discussed. NSA

**N73-33414#** Los Alamos Scientific Lab., N.Mex.
**SELF-FOCUSING OF VERY POWERFUL LASER BEAMS**
B. R. Suydam [1973] 9 p refs
(Contract W-7405-eng-36)
(LA-UR-73-671; Conf-730528-3) Avail: NTIS HC $3.00

Self-focusing was heretofore studied by assuming something equivalent to total collapse of the beam. Computer simulations at high power level show, however, that it is rather some small portions of the beam (e.g., a diffraction spike) that first collapses. Self-focusing was, therefore, examined as a problem in stability theory. The method can be applied to divergent beams and to any medium in which gain is a known function of field strength. The theory agrees well with computer experiments. An absolute limit to the intensity available from a glass laser of near 10 to the 10th power watts/sq cm was found.
Author (NSA)

**N73-33415#** Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
**[EXTENSION OF MICROWAVE FREQUENCIES TO OPTICAL FREQUENCIES] Colsolidated Quarterly Report, 1 Oct. - 31 Dec. 1972**
J. R. Boye 31 Dec. 1972 133 p refs
(Contracts N00014-69-C-0345; N00014-67-A-0325-0005; Grants DA-ARO(D)-31-124-71-G1t1; NSF GK-16574; RL-00534-02; NR Proj. 373-740)
(AD-764808; MDL-Q43; UTEC-MD-73-054) Avail: NTIS CSCL 20/5

The broad purpose of the research activity reported herein is to extend the useful frequency spectrum into the range from microwave frequencies to optical frequencies and to improve existing devices and techniques in the microwave spectrum. At present this objective is being pursued by studies of electron beam devices, quantum electronic devices, plasmas, and solid-state devices. Author (GRA)

**N73-33416#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**SELF-FOCUSING TIMES THREE**
B. Smagin 6 Aug. 1973 9 p Transl. into ENGLISH from Tekhn. Molodezhi (Moscow) no. 2, 1972 p 14-15
(AD-765541; FTD-HT-23-838-73) Avail: NTIS CSCL 20/5

The author discusses the phenomena of self focusing of laser beams. GRA

**N73-33417#** Texas Univ., Austin. Electronics Research Center.
**SELF INDUCED TRANSPARENCY WITH CO2 LASER PULSES PROPAGATING IN AN AMMONIA GAS ABSORBER**
Charles D. David, Jr. 25 May 1973 147 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-765550; TR-149; AFOSR-73-1532TR) Avail: NTIS CSCL 07/4

Self induced transparency has been observed experimentally in two non-degenerate, vibration-rotation transitions in ordinary ammonia, NH3. These transitions could be tuned with external, static electric fields-- i.e., the Stark Effect--to coincide with a pair of CO2 laser transitions at 1072 micrometers. In Stark fields of 12.33 kV/cm and 14.6 kV/cm, respectively, the asQ(5,3,5) and saQ(5,5,5) transitions of the mu(2) fundamental vibration of NH3 are resonant with the P(32) and R(6) CO2 laser lines. That self induced transparency was observed, rather than saturation of the absorbing transitions, is proven by the measurement of an intensity dependent pulse delay as the pulse propagated through the absorber. Groundwork also was laid for an experimental study of the self induced transparency for degenerate transitions. The extent to which self induced transparency phenomena were displayed was determined by the existence and design of a Stark cell. (Modified author abstract)
GRA

**N73-33418#** United Aircraft Corp., East Hartford, Conn. Research Labs.
**INVESTIGATION OF SELF-INDUCED THERMAL EFFECTS OF CO2 LASER RADIATION PROPAGATING IN ABSORBING GASES Annual Report, 30 Apr. 1971 - 29 Apr. 1972**
David C. Smith and Frederick G. Gebhardt 1972 134 p refs
(Contract DAAB07-70-C-0204)
(AD-765520; UARL-L921004-8) Avail: NTIS CSCL 20/5

The report summarizes the work performed during the second year of an experimental and theoretical research program concerning the self-induced thermal distortion effects on cw CO2 laser radiation propagating in absorbing media. The research program is directed toward improving the understanding of the possible limitations imposed by the atmosphere on the propagation of high power laser radiation. The work presented is concerned with essentially the following three different areas: (1) wind simulation experiments using a high pressure gas cell; (2) studies of the kinetic cooling of a gas by absorbing of CO2 laser radiation; and (3) studies of turbulence effects on the self-induced thermal distortion of laser beams. Author (GRA)

# 17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

**N73-33419** Missouri Univ., Rolla.
**IONIZATION MECHANISMS IN CESIUM Ph.D. Thesis**
Yu Bong Hahn 1972 87 p
Avail: Univ. Microfilms Order No. 73-17065

Autoionizing states in Cs between 12 and 20 eV have been studied by electron impact. The retarding-potential-difference method was used to obtain an electron beam with energy spread of about 0.1 eV. To determine the threshold energies, inelastically scattered electrons were analyzed by the trapped electron method. The structure in the electron impact ionization cross section in cesium can be partially accounted for by the mechanisms of autoionization and excitation-ionization of 5p-electrons. A crossed cesium atom-electron beam apparatus was used and the metastable ions were counted with a channel electron multiplier. The gain and total count rate of electron channel multipliers depend strongly on applied magnetic fields. Experimental results are reported for Channeltrons operated in magnetic fields of up to 300 Gauss, and results show that the applied voltage must be increased to about 4000 volts to maintain a sufficiently high gain. Dissert. Abstr.

**N73-33420** Ohio State Univ., Columbus.
**STRESS-CORROSION CRACKING OF STEELS IN LIQUID-AMMONIA ENVIRONMENTS Ph.D. Thesis**
Dennis Calvin Deegan 1973 119 p
Avail: Univ. Microfilms Order No. 73-18883

The stress-corrosion-cracking behavior of steels in liquid-ammonia environments at 25 C was studied using a slow-strain-rate tensile test procedure to produce cracking in an accelerated manner. Primary consideration was given to the effects of controlled additions of environmental species to anhydrous ammonia, especially carbon dioxide, oxygen, nitrogen, and water, and the effect of metallurgical variables on the cracking behavior of steels. In general, the test results obtained were in agreement with previous findings that air contamination can cause cracking, and water additions of 0.2 weight percent inhibit the cracking process, although the limits of effectiveness of water were

extended to 0.08 percent in the present study. New findings in this investigation indicated that the specific causative agents of cracking are oxygen and nitrogen and that the presence of carbon dioxide is not required. Water additions at levels greater than 0.03 weight percent were found to be completely effective in inhibiting cracking in all cases tested. Electrochemical measurements indicated that the mechanism of water inhibition is to assist the repassivation of surface films. Dissert. Abstr.

**N73-33421** Illinois Univ., Urbana.
**THE CYCLIC MECHANICAL AND FATIGUE PROPERTIES OF FERROANELASTIC BETA PRIME GOLD CADMIUM Ph.D. Thesis**
Robert Stephen Karz 1972 131 p
Avail: Univ. Microfilms Order No. 73-17264

The fatigue behavior of beta prime (1.05)cd(0.95)was investigated and found to be exceptional for certain orientations with lives of 100,000 to 1 million cycles at total strain amplitude above 0.05 not uncommon. Fatigue lives were influenced principally by the stress level which controlled the amount of plastic deformation, and stress fatigue resistance was low compared with most metals. Failure always exhibited brittle characteristics. An algorithm was devised to predict mechanical behavior from the twin system orientations and was found in good agreement with experiment for longitudinal strains above 0.04. The cyclic mechanical properties were examined, and a model for the behavior was proposed utilizing previous theories of the restoring force and the Peierls-Nabarro stress for twinning and new concepts. Gold-cadmium was found to have certain strain fatigue resistant applications particularly in electronics where the alloy's high electrical conductivity is utilized. Dissert. Abstr.

**N73-33422** Drexel Univ., Philadelphia, Pa.
**AN EXPERIMENTAL AND THEORETICAL MODEL OF THE DEFORMATION AND DENSIFICATION OF SINTERED POWDER METALLURGY COMPACTS Ph.D. Thesis**
Michael McKay Hagerty 1973 102 p
Avail: Univ. Microfilms Order No. 73-19580

Compression tests performed on sintered iron compacts and various physical models led to the development of an analytical model for porous metal bodies. The model was subjected to mathematical analysis using the Sach's or slab technique in conjunction with an upper bound criterion. The mathematical model predicts accurately the deformation behavior of the physical models. However, the model, which represents deformation of porous material on a microscopic level, does not precisely describe deformation on a macroscopic scale. It is shown that the observed flow behavior of actual sintered compacts is strongly affected by the distributions in pore sizes and pore shapes.
Dissert. Abstr.

**N73-33423** Illinois Univ., Urbana.
**EXPERIMENTAL AND THEORETICAL STUDY OF ELECTRO-EROSION OF METALS Ph.D. Thesis**
Jose Luis GuerreroAlvarez 1972 191 p
Avail: Univ. Microfilms Order No. 73-17223

Single electrical discharges were produced-on 13 electrode materials (Al, Cr, Cu, Fe, Mg, Mo, Nb, Ni, Ta, Ti, V, W, and Zn) under conditions similar of electro discharge machining. Primary consideration was given to Fe and Zn with kerosene as the dielectric, however additional studies were made with both dry and liquid nitrogen as the dielectric. A topographical techniques was developed to measure the volume of metal removed per unit of applied electrical energy, thus allowing a quantitative analysis of the electro-erosion phenomenon. For kerosene, all metals studied except Nb, Mo, and Ta exhibited a larger cathode than anode crater volume. When either dry or liquid nitrogen was used, the anode crater volume was larger. The morphology and surface texture of the electro-erosion craters were studied as a function of the applied electrical energy by means of scanning electron microscopy, transmission microscopy, and a topographical technique. Dissert. Abstr.

**N73-33424** Temple Univ., Philadelphia, Pa.
**THEORETICAL INVESTIGATIONS OF TRANSPORT COEFFICIENT ANOMALIES IN THE VICINITY OF THE NEEL TEMPERATURE OF MAGNETIC METALS Ph.D. Thesis**
Marcel R. Ausloos 1973 254 p
Avail: Univ. Microfilms Order No. 73-18674

The electrical resistivity, thermoelectric power, and normal Hall coefficient of antiferromagnetic metals are calculated in the vicinity of the spin ordering temperature. The generalized theory of Brownian motion is used to express the transport coefficients in terms of correlation functions of the electric and thermal currents. The general expressions can be simplified in the case of metallic conduction under the condition kBT< EF. The electrical conductivity is written in terms of the product of two parameters: the relaxation time of the scattered electrons and the effective number of conduction electrons. Both parameters are defined in terms of a self-energy. The theoretical results are in agreement with the prediction that would be based on comparison of theoretical and experimental results on the thermoelectric power. The magnetic field derivative of the Hall resitivity is also given but the contribution due to the anomalous Hall coefficient is not calculated. Dissert. Abstr.

**N73-33425** Temple Univ., Philadelphia, Pa.
**ANOMALOUS BEHAVIOR OF THE TRANSPORT PROPERTIES OF METALLIC ANTIFERROMAGNETIC SYSTEMS NEAR THEIR NEEL TEMPERATURES Ph.D. Thesis**
Alfred Andrew Fote 1973 145 p
Avail: Univ. Microfilms Order No. 73-18683

A study of the transport properties of several antiferromagnetic systems was undertaken in order to understand the way in which they are affected by the onset of antiferromagnetic ordering at the Neel temperature. First, the behavior of d rho/dT of the three antiferromagnets, CeAl, AuHo, and ErCu was investigated in both zero and applied magnetic fields. Second, the thermal resistivity of CeAl and the thermoelectric power of chromium were studied to determine how these transport properties behave in the vicinity of TN. For antiferromagnets in zero field, a negative divergence in d rho/dT at TN was predicted. However, test results do not support this. In addition, the specific heat on one of the samples, CeAl, was measured and found to behave qualitatively in the same manner as d rho/dT. Finally, the thermoelectric power, S, of chromium below TN was studied. Dissert. Abstr.

**N73-33426** Ohio State Univ., Columbus.
**STRESS CORROSION CRACKING IN GASEOUS AND AQUEOUS ENVIRONMENTS Ph.D. Thesis**
George Earl Kerns 1973 450 p
Avail: Univ. Microfilms Order No. 73-18912

Crack velocities were measured, in both aqueous and gaseous environments, using pre-cracked specimens of a double cantilever beam geometry. Two low alloy, high strength steels (quenched and tempered condition) were investigated. The test environments were an aquenous 3 1/2% sodium chloride solution, and the pure gaseous species H2, D2, H2S, Cl2, HBr, Hcl, NH3, Ch4, and C2H2. In the H2 gas environment, the crack velocity was measured as a function of strength level, applied stress intensity, and gas pressure. In the H2S environment, stress intensity and gas pressure effects were studied. For the aqueous, and other gaseous, environments, the crack velocity was studied as a function of applied stress intensity. As crack growth environments, the gaseous species exhibited widely different behavior. Crack velocities in Cl2, HBr, HCl, and H2S were at least one order of magnitude greater than in pure molecular hydrogen gas. The observation of crack growth in a Cl2 gas environment demonstrated that hydrogen (atomic or molecular) is not a required species for environmentally-induced slow crack growth in gaseous media. Dissert. Abstr.

**N73-33427** Princeton Univ., N.J.
**BULK AND SURFACE COLLECTIVE MODES IN SIMPLE METALS Ph.D. Thesis**
William Hugh Nelson 1972 334 p
Avail: Univ. Microfilms Order No. 73-18771

The bulk and surface collective modes found in the simple metals are discussed. The procedure utilized in this calculation is a modified self-consistent linear response theory, from which the dielectric constants for various systems are obtained and searched for collective excitations. The infinite and finite electron gas is treated, with and without an external magnetic field present, as well as with and without spin, and for different surface geometries. Dispersion relations are calculated and analyzed for

the bulk plasmon, photon, and surface plasmon, as well as for those modes which only exist in an external magnetic field as the helicon, magnetoplasma mode, Bernstein mode, and spin resonance mode. Dissert. Abstr.

**N73-33428** Maryland Univ., College Park.
**FERROMAGNETIC RESONANCE IN NICKEL AND IRON AT HIGH TEMPERATURES Ph.D. Thesis**
Mark S. Rothstein 1972 142 p
Avail: Univ. Microfilms Order No. 73-18743

Measurements were made of ferromagnetic resonance at 9.4 GHz in bulk < 100 < nickel samples for 293 < 653K and in < 100 < iron whisker samples for 293 < T < 1090K. These measurements were made to determine whether the Landau-Lifshitz-Gilbert equation adequately describes f.m.r. with temperature and frequency independent parameters over the entire range of temperatures over which it can be observed. In nickel it was found that for 293 <T< 613K the data are consistant with lambda = 100,000,000/sec, and g = 2.21; this is in agreement with other experiments. At higher temperatures, analysis of the present observations along with the previous observations of Bhagat and Chicklis shows that none of the equations of motion is adequate. In iron, for 293 <T< 950K, the data are adequately explained by the Gilbert equation and a temperature independent lambda = 1.3 x 100,000,000/sec and g = 2.09. At higher temperatures, none of the existing phenomenological equations of motion will give a reasonable description of the data, unless both lambda and g are made functions of the temperature. Dissert. Abstr.

**N73-33429*#** Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
**APPLICATION OF DIFFUSION BONDING TO ELECTRONIC INTERCONNECTION OF FLATPACK LEADS Summary Report**
R. W. Korb and V. F. Lardenoit Jul. 1973 114 p refs
(Contract NAS8-28269)
(NASA-CR-124460; FR-73-01-580) Avail: NTIS HC $7.75 CSCL 11F

Diffusion-bonded joints between gold-plated Kovar leads and indium-plated copper circuit pads offer some advantages for electronic circuit packaging. Test results show that consistent high strength bonds stronger than the copper circuit foil are achieved by parallel-gap bonding at relatively low power settings. The bonds are basically formed by the alloying of the gold, indium and copper at the bond interface. Other low melting metals such as tin can also be used; however, tin does not offer the ease of bonding that results in consistent separation of the copper foil during pull testing. The investigation was conducted in three parts consisting of: (1) an evaluation of the physical strength of resulting bonds at ambient and elevated temperature, (2) a metallurgical analysis of bonds using scanning electron microscopy and nondispersive X-ray analysis, and (3) evaluation and development of various schemes for multiple lead flatpack bonding. Author

**N73-33430*#** Mar-Test, Inc., Cincinnati, Ohio.
**HIGH TEMPERATURE, LOW-CYCLE FATIGUE OF COPPER-BASE ALLOYS IN ARGON. PART 2: ZIRCONIUM-COPPER AT 482, 538 AND 593 C Technical Report, Mar. - May 1973**
J. B. Conway, R. H. Stentz, and J. T. Berling Aug. 1973 48 p
(Contract NAS3-16753)
(NASA-CR-121260; MTI-R003-2-2) Avail: NTIS HC $4.50 CSCL 11F

Zirconium-copper (1/2 hard) was tested in argon over the temperature range from 482 to 593 C in an evaluation of short-term tensile and low-cycle fatigue behavior. The effect of strain rate on the tensile properties was evaluated at 538 C and in general it was found that the yield and ultimate strengths increased as the strain rate was increased from 0.0004 to 0.01/sec. Ductility was essentially insensitive to strain rate in the case of the zirconium-copper alloy. Strain-rate and hold-time effects on the low cycle fatigue behavior of zirconium-copper were evaluated in argon at 538 C. These effects were as expected in that decreased fatigue life was noted as the strain rate decreased and when hold times were introduced into the tension portion of the strain-cycle. Hold times in compression were much less detrimental than hold times in tension. Author

**N73-33431#** Japan Atomic Energy Research Inst., Tokai.
**SPECTROPHOTOMETRIC DETERMINATION OF BORON, COPPER, AND TANTALUM IN NICKEL BASE ALLOYS**
Y. Toita, H. Nagai, K. Sekine, and H. Onishi Jan. 1973 17 p refs In JAPANESE; ENGLISH summary
(JAERI-M-5094) Avail: AEC Depository Libraries

Boron (over a few ppM) is determined by Hayes and Metcalfe's curcumin method after separation by methanol distillation. Two procedures were contrived for copper. One is extraction photometry of copper diethy dithiocarbamate with EDTA for masking; down to 0.003% of copper can be determined. The other procedure is extraction photometry of the copper(I) -2,2 -biquinolyl chelate; down to 0.002% can be determined. In the former case, absorbance of the extract decreases with time, however. The determination of tantalum (down to 0.004%) is made by the extraction-photometry of Methylene Blue fluorotantalate. Before determination, tantalum is separated by methyl isobutyl ketone extraction from hydrochloric-hydrofluoric acid solution. Author (NSA)

**N73-33432#** United Kingdom Atomic Energy Authority, Harwell (England).
**LOW TEMPERATURE PROPERTIES OF TRANSURANIC METALS**
P. W. Sutcliffe Aug. 1972 226 p refs
(AERE-R-7172) Avail: AEC Depository Libraries HC $13.50

The specific heat of plutonium and neptunium was measured below room temperature. The encapsulation method was used in such a way that the calorimeter formed the encapsulation, and the canned specimens could then be handled in an inactive cryostat. The magnitude of the self-heat, particularly of plutonium, meant that a continuous heating method had to be evolved which could deal with the inevitable high rates of rise of temperature. A cryostat and measuring system were constructed and developed such that the specific heat could still be determined with reasonable accuracy. A control system was also developed in order that an adiabatic technique could be employed. The self-heat was utilized as a constant power supply to the calorimeter. A review of the literature values of the half-lives and decay energies of the various radioisotopes present in any sample of a transuranic metal is given since the calculation of the self-heat is critically dependent on these quantities. NSA

**N73-33433#** Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
**THERMODYNAMIC PROPERTY MEASUREMENTS OF SOLID CHROMIUM SESQUIOXIDE AND CHROMIUM IN SOLID ALLOYS WITH IRON AND NICKEL Ph.D. Thesis**
Farhad Niknejad Mazandarany 1972 177 p refs
(Contract AT(11-1)-1791)
(TID-26322) Avail: NTIS HC $11.00

Thermodynamic activities of Cr and Cr2O3 were measured in solid Ni-Cr, Fe-Cr and Fe-Ni-Cr solutions. An electrolytic technique was chosen, using a thoria-yttria solid oxide electrolyte. NSA

**N73-33434#** Minnesota Univ., Minneapolis. Inst. of Technology.
**DIFFUSION STUDIES IN LIQUID METALS Final Report**
R. A. Swalin Apr. 1973 14 p refs
(Contract AT(11-1)-841)
(COO-841-30) Avail: NTIS HC $3.00

Self-diffusion experimentation in liquid metals was conducted over a wide temperature interval under constant-volume conditions to test models that were based on a variety of possible mechanisms of diffusion in liquid metals. The systematic diffusion of a variety of trace concentrations of solutes in liquid silver was investigated and compared to theoretical predictions and to work on the same systems in the solid state. Thermotransport studies in liquid alloys show that solutes may segregate at either the hot end or the cold end. The thermal segregation of solutes in liquid silver and various alkali metals was investigated. NSA

**N73-33435#** Oak Ridge National Lab., Tenn.
**EFFECT OF AGING TIME AND TEMPERATURE ON THE**

**IMPACT AND TENSILE BEHAVIOR OF L-605: A COBALT BASE ALLOY**
D. T. Bourgette Apr. 1973 31 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3734) Avail: NTIS HC $3.75

The effect of aging temperature and time on the impact and tensile behavior of L-605 (Haynes 25 alloy) was studied over the range of 760 to 870 C and 50 to 4000 hr. Prolonged exposure at these temperatures resulted in severe alloy embrittlement. The principal embrittling reaction was the precipitation of the Laves phase, Co2W. At the lower temperatures, however, the precipitation of Co3W may have contributed to embrittlement. Maximum aging embrittlement occurred after 500 hr at 870 C. Impact testing of identically aged specimens at temperatures of 315 to 760 C revealed that 93% of the toughness was lost at the highest test temperature and that all fractures were intergranular. Impact testing at lower temperatures revealed a greater loss of toughness. Specimens aged at 760, 815, and 870 C and tensile tested at room temperature and 540 C showed a severe loss of ductility, the greatest loss occurring in specimens aged at 870 C. Specimens aged at 760 C for 1000 hr exhibited a ductility of 10% at room temperature and 28% at 540 C. Longer aging times (at 760 C) resulted in a continued loss of ductility. Author (NSA)

**N73-33436#** Joint Inst. for Nuclear Research, Dubna (USSR).
**CORRELATION BETWEEN THE OVERALL STABILITY CONSTANTS OF METAL COMPLEXES. 5: NICKEL-ETHOXYACETATE, NICKEL-(ETHYLTHIO) ACETATE AND LEAD-ETHOXYACETATE SYSTEMS**
M. H. Mihailov, V. Ts. Mihailova, and V. A. Khalkin 1972 17 p refs
(JINR-E12-6776) Avail: AEC Depository Libraries HC $3.00

The experimental potentiometric data on nickel-ethoxyacetate, nickel-(ethylthio) acetate, zinc-ethoxyacetate, zinc-(ethylthio) acetate, and lead-ethoxyacetate systems have been analyzed. The validity of the relation connecting the overall stability constants of consecutive metal complexes has been confirmed. The complexity tendency in some metal-ethoxyacetate and some metal-(ethylthio) acetate systems has been discussed. Author

**N73-33437#** Joint Inst. for Nuclear Research, Dubna (USSR).
**CORRELATION BETWEEN THE OVERALL STABILITY CONSTANTS OF METAL COMPLEXES. 4: COPPER METHOXYACETATE, COPPER-ETHOXYACETATE, COPPER THIODIACETATE, CADMIMUM-ETHOXYACETATE AND CADMIUM (ETHYLTHIO) ACETATE SYSTEMS**
M. H. Mihailov, V. Ts. Mihailova, and V.A. Khalkin 1972 15 p
(JINR-E12-6775) Avail: AEC Depository Libraries HC $3.00.

Potentiometric data for the copper - methoxyacetate, copper - ethoxyacetate, copper - thiodiacetate, cadmium - ethoxyacetate, and cadmium - (ethylthio) acetate systems are analyzed. It is shown that for each of these systems a thoretical complexity function can be calculated that fits the experimental data with sufficient accuracy and in which the stability constants are correlated. Author

**N73-33438#** Joint Inst. for Nuclear Research, Dubna (USSR).
**CORRELATION BETWEEN THE OVERALL STABILITY CONSTANTS OF METAL COMPLEXES. 2: APPLICATION TO DATA OBTAINED BY THE POLAROGRAPHIC METHOD FOR METAL-INORGANIC LIGAND SYSTEMS**
M. H. Mihailov, V. Ts. Mihailova, and V. A. Khalkin 1972 16 p refs
(JINR-E12-6773) Avail: AEC Depository Libraries HC $3.00

An analysis of the published data on the cadmium thiocyanate, lead thiocyanate, cadmium iodide and rhodium chloride systems studied polarographically has been performed. It has demonstrated that for each of these systems the experimental data are described with high accuracy by a set of correlated stability constants. Author

**N73-33439#** Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
**AGE-HARDENING PHENOMENA IN V-Ti, V-Ti-Si, V-Zr, AND V-Hf ALLOYS WITH REFERENCE TO THE METALLOIDS N, O, B, AND C**
H. Scholz Oct. 1972 44 p refs Transl. into ENGLISH from German report, KFK-1680
(EURFNR-1060; KFK-1680) Avail: NTIS HC $4.25

An investigation was performed to determine the influence of N, O, B, and C on the precipitation- and age hardening-behavior of the alloys V-Ti, V-3Ti-Si, V-2Zr, and V-1Hf. The study was conducted to evaluate the influence these interstitials have on the age hardening processes and whether this influence has to be taken into account for fuel element cladding. In addition, research was conducted on new applications for age hardened vanadium alloys beyond the field of nuclear application. The alloys V-Ti-O and V-Hf-C show an increase in hardness after temperature treatments. A high carbon content in the alloy V-Ti-O prevents age hardening. Age hardening was increased by additions of boron and silicon. The age hardening processes can be used for a possible improvement of the creep strength to temperatures up to 750 C, as above this temperature over aging occurs after a short time. In order to avoid a too high resistance to deformation during the extrustion of V-Ti-O alloys the extrustion temperature has to be higher than 800 C. Author (NSA)

**N73-33440#** Oak Ridge National Lab., Tenn.
**HEAVY-SECTION STEEL TECHNOLOGY PROGRAM Semi-annual Progress Report, period ending 31 Aug. 1972**
Apr. 1973 78 p
(Contract W-7405-eng-26)
(ORNL-4855) Avail: NTIS HC $3.00

Programs devoted to extending and developing the technology for quantitatively assessing the margins of safety against fracture of the primary containment systems of civilian water reactors are described. Emphasis is on the pressure vessels. Practically all areas of materials technology as related to the pertinent steels and weldments have been or are being investigated. Results of research on unirradiated and irradiated materials are presented along with results of pressure vessel and pipe investigations. NSA

**N73-33441#** Douglas United Nuclear, Inc., Richland, Wash.
**ANALYSIS OF WEAR TEST COMPARING ZIRCALOY-2 ON ZIRCALOY-2 VERSUS 1010 STEEL ON ZIRCALOY-2**
K. E. Fields 12 Feb. 1973 20 p refs Sponsored by AEC
(DUN-8075) Avail: NTIS HC $3.00

Tests were conducted with a wear test machine and a flush discharge mockup to compare the debris generation characteristics of an autoclaved Zircaloy-2 fuel element support and a fuel element support fitted with a 1010 steel shoe. Results confirm that the interaction between Zircaloy-2 on Zircaloy-2 produces significantly more debris than the interaction of 1010 steel on Zircaloy-2. The results of the tests also show that: (1) charge-discharge speed is a prime factor in debris generation with the optimum charge-discharge speed being a nominal 50 feet/minute; and (2) a slight back pressure on a fuel column significantly increases debris generation. Author (NSA)

**N73-33442#** United Kingdom Atomic Energy Authority, Springfields (England). Reactor Group.
**PREDICTION OF THE YIELD STRENGTH ON ISOTHERMAL AGEING OF THE PRECIPITATION-HARDENING ALLOY NIMONIC PE16**
K. B. Smith Feb. 1973 28 p refs
(TRG-Report-2267) Avail: AEC Depository Libraries HC $3.50; HMSO 50p; PHI $2.15

The precipitate-particle strengthening effects are given for the precipitation hardening alloy Nimonic PE16. By considering the mechanism of precipitate-particle strengthening and the variation of the relevant parameters with temperature, general relationships have been established that successfully predict the effect of isothermal aging, in the temperture range 600 to 825 C on the incremental precipitate yield strength. An empirically derived relationship describes the response to isothermal aging in the region of increasing strengh with time and one based on the Orowan theory predicts the decrease in strength with time beyond peak strength. The existence of a transition region between the two types of strengthening resolves the apparent discrepancies implied by some of the earlier experimental data and the good agreement with experiment gives confidence in long-term extrapolation. Author (NSA)

**N73-33443#** Commissariat a l'Energie Atomique, Grenoble (France).
**ROOM-TEMPERATURE DUCTILITY OF DIFFERENT TYPES OF MOLYBDENUM AFTER DIFFERING ANNEALING**
G. Robert and G. Sainfort 1972 13 p In FRENCH Presented at the 3rd Intern. Conf. on Thermionic Elec. Power Generation, Juelich, W. Ger., 5-9 Jun. 1972
(CEA-CONF-2236; Conf-720613-8) Avail: AEC Depository Libraries HC $3.00

After irradiation at 1650 C, the molybdenum can for thermo-electronic emitters shows a marked increase in grain size and sometimes intergranular cracking. An electron scanning study was made of grain boundary precipitates in samples fractured at -196 C. The samples manufactured by melting were found to have a greater tendency for increasing grain size than the sintered samples. This is due to the presence of fine refractory particles in the sintered product. The mechanical properties after annealing were studied by testing at room temperature. It can be seen from the results obtained that there is a greater fragility in all cases, except for the sample made by sintering and containing a fine dispersion of ZrO2 particles. Author (NSA)

**N73-33444#** Oak Ridge National Lab., Tenn.
**EFFECT OF FeF2 ADDITION ON MASS TRANSFER IN A HASTELLOY NiLiF-BeF2-UF-4 THERMAL CONVECTION LOOP SYSTEM**
J. W. Koger Dec. 1972 23 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4188) Avail: NTIS HC $3.25

The compatibility of Hastelloy N with high purity Lif-BeF-UF (65.5-34.0-0.5 mole %) in a low flow temperature gradient system (maximum temperature 704 C, minimum temperature 538 C) was shown to be quite good. The maximum corrosion rate was 0.04 mil/year over 29,50 h of operation. Subsequent experimental additions of FeF2 increased the mass transfer of the system; specifically, the maximum weight loss rate before FeF2 additions was C.0001 mg -sqcm/h while after addition the rate was 006 mg -sqcm/h Cracks which transformed into voids were found in the specimens after exposure to the salt containing FeF2.
Author (NSA)

**N73-33445#** Oak Ridge National Lab., Tenn.
**THERMOPHYSICAL PROPERTIES OF URANIUM-BASED Mo, Nb, Fr, Ti ALLOYS FROM 77 TO 1500 K**
T. G. Kollie, J. P. Moore, D. L. McElroy, H. L. Whaley, R. K. Williams, T. G. Godfrey, W. M. Ewing, and R. S. Graves Jun. 1973 49 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4253) Avail: NTIS HC $4.50

The temperature dependencies of the thermal expansion, specific heat capacity, electrical resistivity, thermal conductivity, Seebeck coefficient, Poisson's ratio, and the shear, Young's and bulk moduli of two uranium-based alloys supplied by AMMRC (QUAD 1 and QUAD 3/4) were measured from 77 to 1460 K. In addition, the room-temperature density and hardness and the liquidus and solidus temperatures were determined. Generally, the properties of the alloys were quite similar to those of pure alpha- or gamma-uranium in their corresponding temperature intervals of stability. Optical microscopy and X-ray diffraction at room temperature revealed that these were multiphased alloys, with the predominate phase being orthorhombic alpha-uranium.
Author (NSA)

**N73-33446#** Oak Ridge National Lab., Tenn.
**INFLUENCE OF VARIOUS ALLOYING ADDITIONS ON THE STRENGTH OF NICKEL-BASE ALLOYS**
H. E. McCoy Dec. 1972 40 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4173) Avail: NTIS HC $4.00

The effects of Mo, Cr, Fe, Si, and Mn on the strength of nickelbase alloys at 25 and 650 C were studied. The strength at 25 C was enhanced by Mo and Cr but not significantly affected by Fe, Si, and Mn in the concentrations studied. At 650 C the yield stress and the creep strength were improved by additions of Mo, Cr, and Si, while Fe and Mn had no measurable effect. These changes are thought to be a result primarily of solid solution hardening, although Mo, Cr, and Si influence the type of carbide that is formed. Author (NSA)

**N73-33447#** Los Alamos Scientific Lab., N.Mex.
**COMPATIBILITY OF ZIRCALOY-4 AND Nb-1 WT PERCENT Zr ALLOY IN HYDROGEN AS A FUNCTION OF TEMPERATURE**
R. E. Riley and T. I. Jones Apr. 1973 20 p
(Contract W-7405-eng-36)
(LA-5169) Avail: NTIS HC $4.00

The susceptibility of zirconium-and niobium-base alloys to hydrogen embrittlement is well known. However, little is known about the compatibility of these materials when exposed to a hydrogen atmosphere at moderately elevated temperatures. Evidence that Zircaloy-4 and Nb-1 wt.% Zr alloys exhibit a reasonable time-temperature-hydrogen compatibility range before catastrophic embrittlement occurs is presented. Author (NSA)

**N73-33448#** Los Alamos Scientific Lab., N.Mex.
**SPECIAL GRAPHITES AND CARBIDE-GRAPHITE COMPOSITES DEVELOPED AT LASL**
R. E. Riley Apr. 1973 64 p refs
(Contract W-7405-eng-36)
(LA-5147) Avail: NTIS HC $5.45

Well-characterized materials containing either TaC and graphite or pure graphite were fabricated utilizing powder metallurgy technique that included hot pressing or hydrostatic pressing and subsequent high temperature heat treatment. Physical structure and thermal properties were investigated, particularly thermal-stress fracture resistance. It was found that well controlled reproducible materials manifesting an excellent distribution of carbide in the graphite matrix could be fabricated utilizing either technique. Thermal properties were affected significantly by the size and relative amounts of TaC and graphite used in the composite. Data on dynamic elastic modulus, thermal expansion, thermal conductivity, and thermal-stress fracture resistance are presented. Author (NSA)

**N73-33449#** Battelle Memorial Inst., Columbus, Ohio.
**ELECTROCHEMICAL STUDY OF THE CORROSION OF HIGH-STRENGTH ALLOYS IN CONTACT WITH ZIRCALOY-4 (LWBR DEVELOPMENT PROGRAM)**
Fred H. Haynie, Warren E. Berry, and Walter K. Boyd May 1973 22 p refs Prepared for Bettis Atomic Power Lab., Pittsburgh
(Contract W-7405-eng-92)
(BMI-X-10260) Avail: NTIS HC $3.25

Potential difference and current flow between galvanic couples were studied in pH 10 ($NH_4OH$) water at 650 F containing 25 to 50 cu cm hydrogen per kg and $<0.1$ ppM oxygen. Film free and prefilmed Zircaloy-4 was found to be anodic to Inconel 718, Hastelloy N, and PH 14-8Mo stainless steel; prefilmed Zircaloy-4 was anodic to Inconel 625; and prefilmed Zircaloy-4 with and without a coating of Neolube lubricant was anodic to AM 350. Film free Zircaloy-4 with and without Neolube coating was cathodic to AM-350. The galvanic coupling of the dissimilar metals to Zircaloy-4 did not adversely affect the corrosion rate of Zircaloy-4 as indicated by the excellent duplication of results for coupled specimens with published results for uncoupled material. The coupling of AM-350 containing transformed martensite to AM-350 containing retained austenite did not produce measurable galvanic effects. Author (NSA)

**N73-33450#** Aerojet Nuclear Co., Idaho Falls, Idaho.
**HEAT-TO-HEAT VARIATIONS IN THE FATIGUE AND CREEP-FATIGUE BEHAVIOR OF AISI TYPE 304 STAINLESS STEEL, AND THE FATIGUE BEHAVIOR OF TYPE 308 STAINLESS STEEL WELD MATERIAL**
C. R. Brinkman and G. E. Korth May 1973 59 p refs
(Contract AT(10-1)-1375)
(ANCR-1097) Avail: NTIS HC $5.45

Results from tests designed to characterize differences in the fatigue or creep-fatigue properties of four heats of Type 304 stainless steel are reported. These tests included strain controlled fatigue with and without tensile hold times as well as cyclic stress-strain curve generation at 593 C. Although differences in cyclic-hardening characteristics were found in the four heats of stainless steel tested, little or no difference in cyclic lifetime occurred, with or with tensile hold times for three of the heats tested. The fourth heat showed a remarkable resistance to creep-fatigue damage which was tentatively

attributed to subtle differences in residual element chemistry. Bilinear constants were also calculated for the four heats, and comparisons are made between bilinear and cyclic stress strain curves. Author (NSA)

**N73-33451#** Aerospace Corp., El Segundo, Calif. Lab. Operations.
**CREEP FRACTURE CHARACTERISTICS OF WELD-REPAIRED CAST Ti-6Al-4V Technical Report, 1 Jul. 1972 - 30 May 1973**
William C. Harrigan, Jr. 31 May 1973 37 p refs
(Contract F04701-73-C-0074)
(AD-765185; TR-0074(4250-10)-2; SAMSO-TR-73-235) Avail: NTIS CSCL 11/6

Constant load creep tests were conducted with cast Ti-6Al-4V bars in air and vacuum at 315 and 650C. Some of the bars were notched in their gauge section and heliarc-welded to simulate a weld repair in a casting. Results indicate that the welding has little influence on the time to rupture of the bars. Fractographic analysis of the bars indicates minor differences in the welded and unwelded fracture surfaces. However, these differences do not affect the microstructural influence on the creep and fracture processes. The prior beta grain size and the alpha platelet size are shown to control the creep fracture of this alloy. These data show that weld repair of titanium castings for creep applications should be acceptable. Author (GRA)

**N73-33452#** Brown Univ., Providence, R.I.
**INELASTIC DEFORMATION OF METALS UNDER DYNAMIC LOADING Final Report, 11 May 1970 - 30 Jun. 1973**
Jacques W. Duffy and Rodney J. Clifton 31 Jul. 1973 6 p refs
(Contract DAHC04-70-C-0035)
(AD-765522; AROD-9288-2-E) Avail: NTIS CSCL 11/6

The research is a study of the plastic response of metals to the application of dynamic loads. The study can be divided conveniently into two parts: (a) experiments on short specimens in which the state of stress is essentially homogeneous and (b) wave propagation investigations. A split-Hopkinson bar for bi-axial loading of short specimens (torsion and compression) at equivalent strain rates of about 400 or 500/sec was developed. The influence of annealing temperature on strain rate effects in copper was studied. Experiments were performed on thin-walled tubes of alpha-titanium in which pre-torqued tubes are subjected to an axial impact. The results of these experiments cannot be explained satisfactorily using a strain rate independent theory. It was found necessary to develop a strain rate dependent theory which then predicted the actual material behavior with good accuracy. (Modified author abstract) GRA

**N73-33453#** Martin Marietta Corp., Denver, Colo.
**THE EFFECTS OF SURFACE LAYER ON PLASTIC DEFORMATION AND CRACK PROPAGATION Final Report**
Irvin R. Kramer Jul. 1973 105 p refs
(Contract DAAG46-70-C-0102; ARPA Order 188)
(AD-765519; AMMRC-CR-71-2/6) Avail: NTIS CSCL 11/6

The crack propagation of 2014-T6 aluminum, titanium (6Al-4V), and 4130 steel (Ys = 180,000 psi) was measured under plane stress and plane strain, and a comparison was made to determine the effect of eliminating or decreasing the surface layer (SLE treatment) on the cracking resistance of the specimens. The data show that, in all cases, the SLE treatment improves the crack resistance. The improvement is on the order of 2 to 5 times, depending on the stress intensity factor. A comparison between the SLE-treated, and shot-peened specimens shows that the SLE treatment also improves the cracking resistance by about a factor of 2 over that obtained from shot-peening. The endurance limit of titanium (6Al-4V) tubing was increased from 70,000 to 90,000 psi by the SLE treatment. Tests made to assess the effectiveness of the SLE treatment on commercial 4130 steel tanks were inconclusive due to the large scatter in the crack propagation rates. It was shown that when specimens of 2014-T6 aluminum, titanium (6Al-4V), and 4130 steel (Ys = 180,000 psi) were fatigued, the surface layer stress increased. The number of cycles required to initiate a propagating crack was determined. Author (GRA)

**N73-33454#** Rockwell International Science Center, Thousand Oaks, Calif.
**INVESTIGATION OF BASIC CREEP MECHANISMS OF TITANIUM ALLOYS Final Report, 31 Mar. 1972 - 30 Jun. 1973**
N. E. Paton, M. W. Mahoney, and J. C. Williams 2 Jul. 1973 42 p refs
(Contract N00019-72-C-0463)
(AD-765784; SC532.8FR) Avail: NTIS CSCL 11/6

High temperature creep resistance of Ti-Zr-Si alloys was studied with the objective of identifying rate controlling creep mechanisms. To achieve this objective, microstructures were systematically altered by changing the Si distribution in a manner designed to suppress a specific creep mechanism. For each microstructure, the apparent activation energy and area was determined, together with the extent of grain boundary sliding. Results from this study have shown that the predominate creep strengthening mechanism at 538C (1000F) for Si bearing Ti alloys is a clustering of solute atoms on mobile dislocations. Direct evidence for this has been obtained by transmission electron microscopy. (Modified author abstract) GRA

# 18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

**N73-33455** Princeton Univ., N.J.
**STUDIES OF OXIDATIVE FRACTURE IN NYLON 66 FIBERS Ph.D. Thesis**
Daniel Bennett Steinhauer 1973 154 p
Avail: Univ. Microfilms Order No. 73-18781

Nylon 6,6 yarn undergoes oxidative stress-cracking when maintained for a sufficient length of time in a slightly alkaline aqueous medium saturated with molecular oxygen at elevated temperature. Helical and/or radial (or transverse) cracks develop on the outer surface of the fiber. Undrawn nylon was found to display primarily helical cracks, while drawn nylon had mostly the radial type. Attempts to correlate crack geometry with sonic modulus, a macroscopic property of the fiber, were unsuccessful. Crack geometry appears to be extremely random as determined by localized residual stress distributions. It was possible, by annealing, to relax residual stresses such that cracking was inhibited. Changes in mechanical properties of the yarn with oxidation, as determined by uniaxial tensile tests, parallel corresponding changes in chemical and physical properties.
Dissert. Abstr.

**N73-33456*#** Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
**A STUDY OF FRACTURE PHENOMENA IN FIBER COMPOSITE LAMINATES Ph.D. Thesis**
H. J. Konish, Jr. Apr. 1973 125 p refs
(Grant NGR-39-002-023; Contracts F33615-70-C-1146; F33615-72-C-1214)
(NASA-CR-132337; SM-73-13) Avail: NTIS HC $8.25 CSCL 11D

The extension of linear elastic fracture mechanics from ostensibly homogeneous isotropic metallic alloys to heterogeneous anisotropic advanced fiber composites is considered. It is analytically demonstrated that the effects of material anisotropy do not alter the principal characteristics exhibited by a crack in an isotropic material. The heterogeneity of fiber composites is experimentally shown to have a negligible effect on the behavior of a sufficiently long crack. A method is proposed for predicting the fracture strengths of a large class of composite laminates; the values predicted by this method show good agreement with limited experimental data. The limits imposed by material heterogeneity are briefly discussed, and areas for further study are recommended. Author

**N73-33457*#** Stanford Research Inst., Menlo Park, Calif.
**PASSIVATION OF PIGMENT PARTICLES FOR THERMAL**

**CONTROL COATINGS Interim Final Report**
E. P. Farley, K. M. Sancier, and S. R. Morrison Jun. 1973 57 p refs
(Contract NAS8-21270)
(NASA-CR-124448) Avail: NTIS HC $5.00 CSCL 11D

Five powders were received for plasma calcining during this report period. The particle size using a fluid energy mill, and obtained pigments that could be plasma calcined. Optimum results are obtained in the plasma calcining of zinc orthotitanate when finely dispersed particles are subjected to a calculated plasma temperature of 1670 C. Increasing the plasma calcining time by using multiple passes through the plasma stabilized the pigment to vacuum UV irradiation was evidenced by the resulting ESR spectra but slightly decreased the whiteness of the pigment. The observed darkening is apparently associated with the formation of Ti(+3) color centers. Author

**N73-33458*#** Avco Government Products Group, Lowell, Mass. Systems Div.
**DEVELOPMENT, FABRICATION AND EVALUATION OF COMPOSITE THERMAL ENGINE INSULATION Final Report**
Sep. 1973 101 p refs
(Contract NAS8-29061)
(NASA-CR-124457; AVSD-0268-73-RR) Avail: NTIS HC $7.25 CSCL 11D

Foil enclosure configurations of 10 variations were fabricated and evaluated. A discussion of the thermal protection system panel design includes: (1) description of 3DSX/foil concept, (2) design environment, (3) material selection, (4) fabrication enclosure, (5) structural design, (6) thermal sizing, and (7) weight analysis. The structural design study includes foil evaluation, venting pressure loads, thermomechanical behavior, and enclosure venting (burst) pressure tests. Results of experimental demonstrations of performance and reuse capabilities are given for both thermal and acoustic testing. T.M.R.

**N73-33459*#** Hughes Aircraft Co., Culver City, Calif.
**DEVELOPMENT OF PORCELAIN ENAMEL PASSIVE THERMAL CONTROL COATINGS Final Report, 1 Jul. 1972 - 20 Jul. 1973**
H. Levin, W. E. Lent, and D. H. Buettner Sep. 1973 82 p refs
(Contract NAS8-27439)
(NASA-CR-124459; P73-282) Avail: NTIS HC $6.25 CSCL 11D

A white porcelain enamel coating was developed for application to high temperature metallic alloy substrates on spacecraft. The coating consists of an optically opacifying zirconia pigment, a lithia-zirconia-silica frit, and an inorganic pigment dispersant. The coating is fired at 1000 to 1150 C to form the enamel. The coating has a solar absorptance of 0.22 and a total normal emittance of 0.82 for a 0.017 cm thick coating. The coating exhibits excellent adhesion, cleanability, and integrity and is thermal shock resistant to 900 C. Capability to coat large panels has been demonstrated by successful coating of 30 cm x 30 cm Hastelloy X alloy panels. Preliminary development of low temperature enamels for application to aluminum and titanium alloy substrates was initiated. It was determined that both leaded and leadless frits were feasible when applied with appropriate mill fluxes. Indications were that opacification could be achieved at firing temperatures below 540 C for extended periods of time. Author

**N73-33460*#** New Mexico Univ., Albuquerque. Technology Application Center.
**PROCEEDINGS OF SYMPOSIUM ON UTILIZATION OF WASTE GLASS IN SECONDARY PRODUCTS**
25 Jan. 1973 365 p refs Conf. held at Albuquerque, N. Mex., 24-25 Jan. 1973; sponsored by N. Mex. Univ., Glass Container Manufacturers Inst., Inc., and Albuquerque Dept. of Environ. Health Sponsored by NASA
(NASA-CR-135792) Avail: NTIS HC $20.25; Technology Application Center, Institute for Social Research and Development, University of New Mexico CSCL 11B

Papers are reported which were presented at the conference on waste glass recovery and re-use in secondary products. The uses considered include: road surfacing, asphaltic concretes, road construction, terrazzo, cement concrete, pozzolan, glass wool, glass-polymer composites, and tiles. Problems of recycling glass in remote areas, and the economics and markets for secondary glass products are discussed. F.O.S.

**N73-33461*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**SYMPOSIUM ON REUSABLE SURFACE INSULATION FOR SPACE SHUTTLE. VOLUME 1: RSI FABRICATION, IMPROVEMENT, MORPHOLOGY AND PROPERTIES**
Washington Sep. 1973 378 p refs Symp. held at Moffett Field, Calif., 1-3 Nov. 1972 3 Vol.
(NASA-TM-X-2719; A-4725-Vol-1) Avail: NTIS HC $8.00 CSCL 11D

Development and production of silica, mullite, and aluminosilicate reusable surface insulation materials for the space shuttle orbiter are discussed. For individual titles, see N73-33462 through N73-33474.

**N73-33462*** Lockheed Missiles and Space Co., Sunnyvale, Calif.
**FABRICATION AND IMPROVEMENT OF LMSC'S ALL-SILICA RSI**
R. M. Beasley, Y. D. Izu, H. N. Nakano, A. A. Ozolin, and A. Peachman *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 1-15 (For availability see N73-33461 24-18)
CSCL 11D

The LI-1500 and LI-900 all silica RSI materials have made the transition from laboratory to manufacturing operation. Improvements in both quality and reproducibility have been achieved. The LI-1500 material has displayed superior reliability in evaluations conducted at various facilities. The dependable performance of the material is attributed to the adherence to the stringent requirements of the numerous material, process, and product control evaluations and inspection points performed during manufacture. Author

**N73-33463*** General Electric Co., Philadelphia, Pa.
**PROCESSING OF RIGIDIZED REI-MULLITE INSULATIVE COMPOSITES**
J. J. Gebhardt, P. D. Gorsuch, and M. A. Braun *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 17-60 refs (For availability see N73-33461 24-18)
CSCL 11D

Systematic development and evaluation of ceramic fiber Mullite are summarized: (1) Major reductions in thermal protection system weight have been achieved by reducing the density and thermal conductivity of the insulation by 20 and 25 percent; (2) already adequate structural margins-of-safety have been greatly enhanced by increasing the tensile strength and strain-to-failure capabilities of the insulation by factors of 3 and 2; (3) cost effectiveness has been increased through the achievement of a high degree of uniformity and reproducibility of properties and through process simplification and binder modifications; and (4) maximization of multimission capability at surface temperatures of 1644 K has been achieved through firing cycle adjustments and the development of a material with high dimensional stability. Author

**N73-33464*** Grumman Aerospace Corp., Bethpage, N.Y.
**DEVELOPMENT AND CHARACTERIZATION OF CPI SURFACE INSULATION**
A. Tobin, C. Feldman, J. Reichman, M. Russak, and A. Varisco *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 61-85 (For availability see N73-33461 24-18)
CSCL 11D

A new type of reusable surface material that could find application as a component of the thermal protection system of the space shuttle orbiter is discussed. These materials consist of 20-30% dense closed cell high emittance glass ceramic foams formulated by sintering an intimate mixture of fly ash cenospheres with 4-12 wt % cobalt oxide. These unique ceramic foams exhibit: (1) High mechanical strengths; (2) no need for waterproof coating due to the non-interconnecting cell network; (3) high émissivities; (4) ability to withstand space shuttle thermal environments

with no loss of reuse capability; and (5) a machinable ceramic with capability of maintaining the close tolerances required of an integrated heat shield system. Author

**N73-33465*** Avco Corp., Lowell, Mass. Systems Div.
**FUSED SILICA SURFACE COATING FOR A FLEXIBLE SILICA MAT INSULATION SYSTEM**
W. H. Rhodes *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 87-105 refs (For availability see N73-33461 24-18)
(Contract NAS9-12490)
CSCL 11D

Fused silica insulation coatings have been developed for application to a flexible mat insulation system. Based on crystalline phase nucleation and growth kinetics, a 99+% $SiO_2$ glass was selected as the base composition. A coating was developed that incorporated the high emissivity phase $NiCr_2O_4$ as a two phase coating with goals of high emittance and minimum change in thermal expansion. A second major coating classification has a plasma sprayed emittance coating over a sealed pure amorphous $SiO_2$ layer. A third area of development centered on extremely thin amorphous $SiO_2$ coatings deposited by chemical vapor deposition. The coating characterization studies presented are mechanical testing of thin specimens extracted from the coatings, cyclic arc exposures, and emittance measurements before and after arc exposures. Author

**N73-33466*** Martin Marietta Corp., Denver, Colo.
**MAR-SI, MARTIN SURFACE INSULATION**
P. Paul Plank, Arthur Feldman, William C. Miiller, John F. Creedon, and Joseph M. Toth, Jr. *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 107-153 (For availability see N73-33461 24-18)
CSCL 11D

The development of an alumina/silicate based composite material for space shuttle reusable surface insulation is reported. Physical property determinations, environmental testing, design analysis, and projected costs for a thermal protection system are outlined. G.G.

**N73-33467*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**SILICA REUSABLE SURFACE INSULATION IMPROVEMENT RESEARCH**
H. E. Goldstein, M. Smith, D. G. Leiser, V. Katvala, and D. Stewart *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 155-196 refs (For availability see N73-33461 24-18)
CSCL 11D

Fiber characterization, fabrication processes, physical properties, and thermal responses are investigated to improve silica reusable surface insulation tiles. Criteria for fiber selection on the basis of chemical composition, shrinkage, and devitrification have been defined and a simple process for fabricating silica surface insulation materials has been developed that produces only 5% shrinkage and no devitrification of tiles at 1533 K in ten hours. Anisotropic tile with improved weak direction strength has been fabricated using conventional molding techniques. G.G.

**N73-33468*** McDonnell-Douglas Astronautics Co., St. Louis, Mo.
**RADIANT HEAT TRANSFER IN REUSABLE SURFACE INSULATION** c33
T. A. Hughes, R. M. F. Linford, R. J. Chmitt, and H. E. Christensen *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 197-226 refs (For availability see N73-33461 24-18)
(Contract NAS8-26115)
CSCL 20M

During radiant testing of mullite panels, temperatures in the insulation and support structure exceeded those predicted on the basis of guarded hot plate thermal conductivity tests. Similar results were obtained during arc tunnel tests of mullite specimens. The differences between effective conductivity and guarded hot plate values suggested that radiant transfer through the mullite was occurring. To study the radiant transport, measurements were made of the infrared transmission through various insulating materials and fibers of interest to the shuttle program, using black body sources over the range of 780 to 2000 K. Experimental data were analyzed and scattering coefficients were derived for a variety of materials, fiber diameters, and source temperature. Author

**N73-33469*** General Electric Co., Philadelphia, Pa.
**OPTIMIZATION OF REI-MULLITE PHYSICAL PROPERTIES**
R. A. Tanzilli, S. Musikant, P. N. Bolinger, and J. P. Brazel *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 277-260 refs (For availability see N73-33461 24-18)
CSCL 11D

Micromechanical and thermal modeling studies prove that ceramic fiber mullite materials is the only system capable of shuttle thermal protection to 1644 K. Hafnia pigmentated mullite surface coatings meet both orbital and reentry thermal radiative requirements for reuse without refurbishment. Thermal and mechanical models show growths potentials associated with the mullite system for a factor of 2 improvement in mechanical properties, and a factor of 2 to 3 reduction in thermal conductivity. Author

**N73-33470*** Lockheed Missiles and Space Co., Sunnyvale, Calif.
**SILICA RSI MORPHOLOGY AND PROPERTIES**
R. M. Beasley and J. C. Robinson *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 261-274 (For availability see N73-33461 24-18)
CSCL 11D

The morphology of all silica materials studied has been noncrystalline and resistant to any phase transformations upon subsequent thermal testing representative of the shuttle environment envelope. The development of an extremely dependable reusable surface insulation material family offering the inherently superior characteristics of amorphous silica for the shuttle is described. Author

**N73-33471*** Battelle Columbus Labs., Ohio.
**EVALUATION OF RSI MATERIALS**
C. W. Kistler, D. E. Niesz, and E. L. Foster *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 275-309 ref (For availability see N73-33461 24-18)
CSCL 11D

Novel attachment and strain-measuring techniques were developed to obtain valid mechanical and thermophysical property data to above 1530 K in air on nonmetallic insulators and their coatings. The lever-arm extensometer developed used for measuring thermal and/or mechanical strain. Thermal expansion measurements were made on a tensile load to define their softening points. Creep characteristics of the insulators were monitored at elevated temperatures and found to become significant above 1090 K (1500 F). Author

**N73-33472*** Washington Univ., Seattle.
**PORE STRUCTURE ANALYSIS OF RSI TILE**
O. J. Whittemore, Jr. and L. W. Smiser *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 311-325 refs (For availability see N73-33461 24-18)
CSCL 11D

Mercury porosimetry gives a means of characterizing RSI tile pore structure in terms of porosity, pore size distribution, bulk density, specific surface area, mean pore diameter, and mean fiber diameter. It also allows the determination of the effects of heat treatment on these parameters. It is limited in application to open-pored structures, however, since any closed pore volume is ignored. Author

**N73-33473*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**SPECTRAL AND TOTAL NORMAL EMITTANCE OF REUSABLE SURFACE INSULATION MATERIALS**
Andronicos G. Kantsios, S. Franklin Edwards, and Dennis L. Dicus *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 327-347 refs (For availability see N73-33461 24-18)

CSCL 11D

**Measurements of spectral and total normal emittance have been** made on three types of reusable external insulation materials proposed for space shuttles. Emittances were measured in the spectral range 1 to 15 micrometer at temperatures of 800 K and 1100 K using a radiometric measurement technique. Results indicated that the total normal emittance of these materials was less than 0.8 between 800 K and 1300 K. The total normal emittance decreased with increasing temperature. The three ceramic coating candidate materials exhibited a similar spectral emittance distribution. Author

**N73-33474*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**AN EXPLORATORY STUDY OF THE MICROSTRUCTURE OF MULLITE FIBERS**

G. Santoro, H. B. Probst, and B. Buzek *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 349-369 refs (For availability see N73-33461 24-18)

CSCL 11E

The microstructures of mullite composition fibers were examined by transmission electron microscopic techniques and by X-ray diffraction analyses. Both spun and monofilament fiber structures contained little porosity, nor did the degree of porosity change after heating the monofilament to 1205 C for one half hour. Thermal exposure produced crystallite growth and nucleation from the amorphous phase in all three of the spun fibers. After 116 hours at 1426 C, the crystallites of the standard spun fibers became contiguous. In addition, the surface crystallites of these fibers were found to be more than twice as large as the interior crystallites. Author

**N73-33475*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**SYMPOSIUM ON REUSABLE SURFACE INSULATION FOR SPACE SHUTTLE. VOLUME 2: ENVIRONMENTAL TESTING**

Washington Sep. 1973 574 p refs Symp. held at Moffett Field, Calif., 1-3 Nov. 1972 3 Vol.

(NASA-TM-X-2720; A-4725-Vol-2) Avail: NTIS HC $10.50

CSCL 11D

Environmental space simulation test results are reported for mullite, silica, and alumino-silicate reusable fibrous space shuttle surface insulation materials. For individual titles, see N73-33476 through N73-33489.

**N73-33476*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**AERODYNAMIC SIMULATION TESTS OF RSI PANELS** **c01**

F. J. Centolanzi, N. B. Zimmerman, M. A. Covington, and F. H. Nichols *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 371-423 (For availability see N73-33475 24-18)

CSCL 01A

The technique of mixing argon with air was used to simulate the temperature-time trajectory experienced by space shuttle vehicle insulation panels. Gap heating appears to be highly dependent upon gap design, it is relatively low for interlocking and tapered panel designs and significantly higher for a wider, unfilled gap design. The heating rate appears to be significantly higher at the windward facing edges of flush tiles and is aggravated at forward facing steps. This heating, however, is highly dependent on step heights relative to some characteristic thickness of the boundary layer. Author

**N73-33477*** McDonnell-Douglas Astronautics Co., St. Louis, Mo.

**CONVECTIVE HEATING TESTS OF REUSABLE SURFACE INSULATION JOINTS AND GAPS** **c33**

H. E. Christensen and D. A. Osborne *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 425-483 refs (For availability see N73-33475 24-18)

(Contracts NAS9-12082; NAS9-12854)

CSCL 20M

Arc tunnel tests on convective heating in surface insulation plate joints and gaps show that excessively wide gaps experience significant convective heating and may result in bondline overheating. A contoured joint affords more heat protection than a butt joint. Author

**N73-33478*** General Electric Co., Philadelphia, Pa.

**ENTRY ENVIRONMENTAL SIMULATION TESTING OF REI-MULLITE TPS** **c01**

D. E. Florence, R. A. Brewer, and T. E. Hess *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 485-524 refs (For availability see N73-33475 24-18)

CSCL 01A

Glassy fibrous mullite coatings exhibit noncatalytic surface characteristics which limit surface temperature rise under certain convective heat flux conditions. Thermal conductivity design curves provide good agreement with test results. The inclusion of shine-in effects results in improved accuracy of transient temperature gradient predictions for the materials. Author

**N73-33479*** Battelle Columbus Labs., Ohio.

**PLASMA ARC TESTING TECHNIQUES FOR SPACE SHUTTLE REUSABLE SURFACE INSULATION (RSI)**

Ira M. Grinberg and Ross G. Luce *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 525-557 refs (For availability see N73-33475 24-18)

CSCL 11D

Thermal and mechanical property evaluations of three candidate RSI materials are presented. The techniques used to characterize material response during plasma arc exposures are described. Author

**N73-33480*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**CYCLIC ARC PLASMA TESTS OF RSI MATERIALS USING A PREHEATER**

D. A. Stewart *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 559-589 refs (For availability see N73-33475 24-18)

CSCL 11D

The results of a test program are reported in which a preheater was used with an arc plasma stream to study the thermal response of samples of candidate reusable surface insulation materials for the space shuttle. The preheater simulated the shuttle temperature history during the first and last portions of the test cycle, which could not be simulated by the air arc plasma flow. Pre- and post-test data taken for each of the materials included magnified views, optical properties, and chemical analyses. The test results indicate that the mullite base samples experience higher surface temperatures than the other materials at heating rates greater than 225 kw/sq m. The ceramic fibrous mullite and silica coatings show noncatalytic wall behavior. Internal temperature response data for the materials are compared and correlated with analytical predictions. Author

**N73-33481*** Acurex Corp., Mountain View, Calif.

**ARC JET TESTS OF RSI MATERIALS: SCREENING AND COMPARATIVE EVALUATION**

John W. Schaefer and Nick S. Vojvodich (NASA. Ames Res. Center) *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 591-622 ref (For availability see N73-33475 24-18)

(Contracts NAS2-6445; NAS2-6600)

CSCL 11D

Cyclic convective heating test results show that all surface insulation materials tested exhibit a wide range of surface emittance and catalytic activity depending on their surface coatings. Coatings have a significant effect on the overall material response depending on boundary layer characteristics. Author

**N73-33482*** Lockheed Missiles and Space Co., Sunnyvale, Calif.

**SILICA RSI ENTRY SIMULATION TESTS** **c01**

R. P. Banas, J. O. Donaldson, and J. Jue *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 623-666 refs (For availability see N73-33475 24-18)

CSCL 01A

**Simulated reentry heating of the all-silica surface insulation** material under a variety of conditions including arc jet and radiant lamp facilities for up to 100 simulated flight cycles has demonstrated consistent thermal performance capability. Consistent predictability along with demonstrated coating integrity and dimensional stability to 1645 K validates the earlier selection of the all-silica material for the RSI application. Author

**N73-33483*** General Electric Co., Philadelphia, Pa.

**ENVIRONMENTAL TESTING OF REI-MULLITE THERMAL PROTECTION SYSTEM FOR THE SPACE SHUTTLE ORBITER** c33

R. Gluck, R. Romano, and H. Thibault *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 667-708 refs (For availability see N73-33475 24-18)

CSCL 20M

Tests conducted to evaluate performances in the natural environments of salt spray, humidity, rain, vacuum, and cryogenic temperatures have shown the ceramic mullite fiber is completely compatible and that these environments have no adverse effects on subsequent mission performance. Rain erosion testing has indicated a damage threshold that must be accounted for in the final design. Tests conducted to evaluate the performance of ceramic mullite fiber to induced acoustic, re-entry, and structural load environments again have shown complete capability to fulfill mission environments. Although minor cracking of the sidewall coating was seen to occur throughout the induced environment test program, sidewall designs configured to provide increased flexibility have been successfully tested. Author

**N73-33484*** Lockheed Missiles and Space Co., Sunnyvale, Calif.

**ENVIRONMENTAL COMPATIBILITY OF THE ALL-SILICA RIGID SURFACE INSULATION** c33

S. J. Housten, J. A. DeRuntz, and D. R. Elgin *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 709-730 ref (For availability see N73-33475 24-18)

CSCL 20M

Testing has demonstrated the compatibility of the all-silica surface insulation system to a variety of space shuttle orbiter environmental aspects for launch, on-orbit, and special reentry conditions. Among the more important results are the success of the cold soak tests, which indicate the suitability of the foam/bond attachment system with a 2 mm thick foam pad for strain isolation, and the reentry temperature overshoot tests (to 1924 K), which show that this system can tolerate considerable dispersion in reentry heating environment. Author

**N73-33485*** McDonnell-Douglas Astronautics Co., St. Louis, Mo.

**SIMULATED METEOROID PENETRATION OF REUSABLE SURFACE INSULATION**

J. K. Lehman and H. E. Christensen *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 731-763 (For availability see N73-33475 24-18)

CSCL 11D

Meteoroid impact simulation test results on insulation tiles were used to determine penetration resistance of reusable surface insulation attached to simulated shuttle structures. The probability of no meteoroid damage to a typical shuttle orbiter was determined. Specimens were plasma jet tested to determine effects of various size meteoroid cavities on their thermal performance. None of the tiles failed catastrophically, but large, egg-shaped craters did result from meteoroid penetration. The metallic side of a specimen that was completely penetrated showed a petalled hole typical for thin gage shielded structures. Author

**N73-33486*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

**EFFECTS OF SEA SALTS ON THE PHYSICAL CHARACTERISTICS OF REUSABLE SURFACE INSULATION**

Philip O. Ransone and Dennis L. Dicus *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 765-792 (For availability see N73-33475 24-18)

CSCL 11D

**Test results show that sea salt contamination and thermal cycles** cause significant changes in the morphology of surface insulation coatings with increased melting. Sea salt contamination and thermal cycles do not have a significant effect on emittance of mullite and silica composite coatings at high temperatures (1300 K). At the lower temperatures there is apparently some effect on emittance but the evidence is inconclusive because of the absence of multiple tests. Author

**N73-33487*** Washington Univ., Seattle. Ceramic Engineering Div.

**CHARACTERIZATION OF RSI COATING**

A. D. Miller, S. H. Garofalini, L. W. Smiser, and J. I. Mueller *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 793-850 (For availability see N73-33475 24-18)

CSCL 11D

X-ray diffraction analyses on mullite, silica, and ceramic mullite fiber coating materials to investigate the effects of thermal cycling, show that ceramic mullite fiber coating porosity is little affected by cycling to 1250 C and that material pores are mostly smaller than 15 nm. Some mullite coatings experience a slight increase in crystobalite with somewhat increased porosity. Silica coatings show a marked tendency to precipitate cristobalite with increased porosity and dimensional instability. G.G.

**N73-33488*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**CHEMICAL AND MORPHOLOGICAL CHANGES OF REUSABLE SURFACE INSULATION COATINGS AS A FUNCTION OF CONVECTIVELY HEATED CYCLIC TESTING**

D. B. Leiser, D. A. Stewart, and H. E. Goldstein *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 851-894 refs (For availability see N73-33475 24-18)

CSCL 11D

The effects of convective heating upon reusable surface insulation coatings were studied utilizing scanning electron microscopy, X-ray fluorescence, and X-ray diffraction. Samples of coated silica, mullite, and ceramic mullite fiber were cycled in an arc plasma stream up to 15 times for 15 minutes per cycle at surface temperatures simulating those on the space shuttle vehicle. The surfaces of ceramic mullite fiber and mullite coatings were roughened substantially by the convectively heated environment while the silica was significantly smoothed after testing. Scanning electron microscopy also showed surface cracking of varying degrees in all of the coatings. The surface chemistry of the coatings as examined by X-ray fluorescence revealed that significant changes in composition were occurring during cycling, particularly within the mullite coating. Author

**N73-33489*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

**REUSABLE SURFACE INSULATION THERMAL PROTECTION SYSTEMS TEST EVALUATION STATUS**

George Strouhal and Donald J. Tillian *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 895-934 (For availability see N73-33475 24-18)

CSCL 11D

Changes in coating morphology of mullite, silica, and ceramic mullite fiber at two heating rates are described followed by a discussion of the changes in surface chemistry that occur during convective heating tests. Subsequently, the surface chemistry changes observed are compared to similar data obtained from radiantly heated coatings and the significance of the difference between the results is discussed. Finally, the changes in chemistry of the coatings in cross section before and after convectively heated cyclic testing are discussed and the significance of surface chemistry changes are described. Results indicate that the thermal conductivity of mullite surface insulation is higher than that of silica insulation, based on thermal response data. Acoustic excitation of cracked silica tiles does not lead to catastrophic failure such as spallation or tile loss. Cracks in mullite material after thermal exposure lead to fracturing of the coating and surface insulation material after acoustic excitation. Author

**N73-33490*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**SYMPOSIUM ON REUSABLE SURFACE INSULATION FOR SPACE SHUTTLE. VOLUME 3: THERMAL PROTECTION SYSTEM DESIGN AND OPTIMIZATION**
Washington Sep. 1973 379 p refs Symp. held at Moffett Field, Calif., 1-3 Nov. 1972 3 Vol.
(NASA-TM-X-2721; A-4725-Vol-3) Avail: NTIS HC $8.00 CSCL 11D

Thermostructural design problems of space shuttle external heat shielding systems consider the space environmental effects on the various properties of mullite, silica, and ceramic composite materials. For individual titles, see N73-33491 through N73-33501.

**N73-33491*** General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
**CHARACTERIZATION OF ADHESIVES FOR ATTACHING REUSABLE SURFACE INSULATION ON SPACE SHUTTLE VEHICLES**
H. P. Owen and M. T. Carroll *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 935-964 refs (For availability see N73-33490 24-18)
CSCL 11A

An extensive development and testing program on adhesive systems shows that: (1) A closed cell silicone rubber sponge bonded to substrates with thin bond lines of glass filled adhesive exhibits density and modulus values approximately one third that of solid silicone adhesives; (2) utilization of glass or phenolic microballoons as fillers in silicone adhesives reduces density but increases moduli of the vulcanized materials; (3) the silicone elastomer based adhesives appear to be complex systems rather than homogeneous, isotropic materials. Tensile, shear, and compression properties plotted versus temperature verify this conjecture; and (4) constant strain-stress relaxation tests on glass-filled adhesive show that stress relaxation is most pronounced near the glass transition temperature. Author

**N73-33492*** North American Rockwell Corp., Downey, Calif.
**EFFECT OF OPTICAL PROPERTIES ON THERMAL DESIGN**
C. L. Statham and R. T. Tsutsui *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 965-980 (For availability see N73-33490 24-18)
CSCL 11B

When considering the effect of external surface optical properties, subsystems contained within the vehicle must be considered in addition to the thermal protection system. Representative subsystem temperature limits for orbital flight (long term) and entry transients (short term) are presented. Author

**N73-33493*** Grumman Aerospace Corp., Bethpage, N.Y.
**CLOSED-PORE INSULATION THERMAL PROTECTION SYSTEM DESIGN CONCEPT DEVELOPMENT**
A. Varisco and H. G. Harris *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 981-1028 (For availability see N73-33490 24-18)
CSCL 11D

The development of a unique closed-pore ceramic foam insulation (CPI) produced from low cost fly ash cenospheres is reported for space shuttle external thermal protection. Two basic design approaches were developed: bonded and mechanically fastened. A description of the concepts is presented in addition to fabrication and test results. Author

**N73-33494*** McDonnell-Douglas Astronautics Co., St. Louis, Mo.
**MECHANICAL ATTACHMENT OF REUSABLE SURFACE INSULATION TO SPACE SHUTTLE PRIMARY STRUCTURE** c15
R. W. Fleck and J. K. Lehman *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1029-1061 (For availability see N73-33490 24-18)
CSCL 13H

Three methods of attaching surface insulation tiles to shuttle primary structure have been proposed: direct bond, mechanical attachment, and subpanels with standoffs. The direct bond approach is lightweight but is difficult to refurbish and inspect. The subpanel approach is heavier but allows for easy refurbishment since subpanels are easily removed and replaced. The mechanical attachment approach allows easy refurbishment and inspection and is lightweight when an efficient insulator is used between surface insulation tiles and primary structure. Author

**N73-33495*** General Electric Co., Philadelphia, Pa.
**OPTIMUM TPS DESIGN WITH REI-MULLITE**
T. E. Hess, R. J. Michalak, and R. A. Brewer *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1063-1120 ref (For availability see N73-33490 24-18)
CSCL 11D

It has been shown that a ceramic mullite fiber/mullite insulation has adequate margins-of-safety based on minimum strengths for the critical thermostructural conditions of the shuttle mission. Introduction into the design of the new lower density foam bond material provides cold soak and cold entry capability at 116 K (-250 F). Finally, design solutions to the coating cracking tendencies have been identified and the solution analytically verified with three dimensional thermostructural analysis. Author

**N73-33496*** Lockheed Missiles and Space Co., Sunnyvale, Calif.
**SILICA RSI FOR APPLICATION TO THE SHUTTLE ORBITER**
K. J. Forsberg, J. Jue, M. H. Kural, and F. A. Velligan *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1121-1183 ref (For availability see N73-33490 24-18)
CSCL 11D

Silica reusable surface insulation is analyzed for its cold soak properties, bond properties at low temperature, gap and step heating effects, and aerodynamic surface roughness effects to determine space shuttle weight and cost sensitivity to structure subsystem weights. Computerized simulation studies show that total program cost savings of silica (vs. mullite) exceed thermal protection system design and development costs and that an early introduction of silica increases total program cost savings. G.G.

**N73-33497*** Avco Corp., Lowell, Mass.
**A NON RIGID REUSABLE SURFACE INSULATION CONCEPT FOR THE SPACE SHUTTLE THERMAL PROTECTION SYSTEM** c33
J. G. Alexander *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1185-1225 (For availability see N73-33490 24-18)
CSCL 20M

A reusable thermal protection system concept was developed for the space shuttle that utilizes a flexible, woven ceramic mat insulation beneath an aerodynamic skin and moisture barrier consisting of either a dense ceramic coating or a super alloy metallic foil. The resulting heat shield material has unique structural characteristics. The shear modulus of the woven mat is very low such that bending and membrane loads introduced into the underlying structural panel remain isolated from the surface skin. Author

**N73-33498*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**RESULTS OF RSI THERMAL-STRUCTURAL ANALYSIS** c33
O. E. Pigg *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1227-1267 (For availability see N73-33490 24-18)
CSCL 20M

Thermostructural comparisons of mullite and silica reusable surface insulation materials for space shuttle application show that mullite is much more subject to thermal stress failure than silica composite materials. G.G.

**N73-33499*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**INTERFERENCE HEATING TO CAVITIES BETWEEN SIMULATED RSI TILES** c33
Charles B. Johnson *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1269-1276 (For availability see N73-33490 24-18)

CSCL 20M

**Test results for full scale simulated surface insulation tiles on** both the tunnel wall and in the free stream, for in-line and staggered tile orientations, are summarized as follows: (1) The staggered tile orientation has heating on the forward face which is a factor of 4.5 times higher than the heating to the forward face of the in-line tile orientation; (2) the longitudinal gap heating was the highest for the 0.3175 cm gap and the lowest for the 0.1587 cm gap; and (3) there was an order of magnitude decrease in the heating on the forward face of a spanwise gap when the gap size was decreased from 0.3175 cm to 0.1587 cm. Author

**N73-33500*** Washington Univ., Seattle. Ceramic Engineering Div.

**EFFECT OF CRISTOBALITE ON THE MECHANICAL PROPERTIES OF SILICA RSI MATERIALS**

Pramod K. Khandelwal and William D. Scott *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1277-1289 refs (For availability see N73-33490 24-18)

(Contract NAS2-6541)

CSCL 11D

The strength of various silica surface insulation materials was measured after high temperature heat treatment to develop substantial crystalline phases, and after low temperature thermal cycling through the alpha-beta cristobalite transformation. It appears that the presence of cristobalite in the structural elements (the fibers) is highly detrimental to tensile strength. When crystallization does not occur in silica material, the strength improves with heat treatment. Author

**N73-33501*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**EMITTANCE OF RSI COATINGS DETERMINED FROM RADIATION MEASUREMENTS IN ARC JET TESTS**

R. M. Wakefield and D. A. Stewart *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1291-1311 refs (For availability see N73-33490 24-18)

CSCL 11D

Simultaneous measurements were made on three surface insulation coatings for total surface radiation and radiation at discrete wavelengths between 0.88 and 4.5 microns. The mullite coating radiated all the applied heat at convective heat rates of 204 and 295 kw/sq m. Radiation from the ceramic mullite fiber coating was 170 kw/sq m at a heat rate of 454 kw/sq m. Effective total emissivity and spectral emissivity values were evaluated; all three coatings were significantly non-grey. Effective total emissivity values were 0.79 for mullite, 0.50 for ceramic mullite fiber, and 0.78 for silica composite. Author

**N73-33502*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**EXPERIMENTAL AND THEORETICAL INVESTIGATION OF HT-S/PMR-PI COMPOSITES FOR APPLICATION TO ADVANCED AIRCRAFT ENGINES**

M. P. Hanson and C. C. Chamis [1973] 33 p refs Proposed for presentation at 29th Reinforced Plastics Tech. and Management Conf., Washington, D. C., 5-8 Feb. 1974; sponsored by Reinforced Plastics/Composites Inst. of the Soc. of the Plastics Ind., Inc.

(NASA-TM-X-71459; E-7700) Avail: NTIS HC $3.75 CSCL 11D

Investigations were performed in order to: (1) demonstrate that high quality angleplied laminates can be made from HT-S/PMR-PI (PMR in situ polymerization of monomeric reactants), (2) characterize the PMR-PI material and to determine the HT-S unidirectional composite properties required for composite micro and macromechanics and laminate analyses, and (3) select HT-S/PMR laminate configurations to meet the general design requirements for high-tip-speed compressor blades. The results of the investigation show that HT-S/PMR laminate configurations can be fabricated which satisfy the high-tip-speed compressor blade design requirements when operating within the temperature capability of the polyimide matrix. Author

**N73-33503#** Los Alamos Scientific Lab., N.Mex.

**CMB-13 RESEARCH ON CARBON AND GRAPHITE**

**Summary Progress Report, 1 May - 31 Jul. 1972**

M. C. Smith Mar. 1973 21 p refs

(Contract W-7405-eng-36)

(LA-5223-PR; PR-22) Avail: NTIS HC $3.25

Results of ablation tests in the sublimation regime of tempertures, above about 3500 K, indicated only relatively small differences in mass loss rate among a wide variety of LASL experimental graphites. However, correlation of these differences with raw materials characteristics, manufacturing procedures, and microstructures before and after testing has provided useful clues to both ablation mechanisms and means of improving ablation resistance at very high temperatures. In an investigation of coal-tar and petroleum-pitch binders, it was found that in general the higher the quinoline insoluble content of the pitch the greater its coking value and the smaller the crystallite size of its graphitized carbon residue. Results are reported for the use of experimental phenolic binders, organometallic additions to both resin and pitch binders, and impregnation experiments using both resin and pitch impregnants. In an extension of particle packing theory, it was found necessary to separate triangular distributions into three general families according to their skewness. Author (NSA)

**N73-33504#** Los Alamos Scientific Lab., N.Mex.

**MC.M'O2 COMPOSITES: A NEW THERMAL INSULATOR**

R. E. Riley and J. M. Taub Feb. 1973 18 p refs

(Contract W-7405-eng-36)

(LA-5136) Avail: NTIS HC $3.00

The number of thermal insulating materials suitable for greater than 2000 C operation in H2 is extremely limited. Data obtained on a series of refractory metal carbide-refractory metal oxide composites developed for this purpose are presented. The basis for the excellent insulating characteristics of these composites is the formation of an oxycarbide having the general formula MM'CxOy, where M and M' may be selected from the group consisting of titanium, zirconium, hafnium, vanadium, niobium, tantalum, thorium, and uranium. Author (NSA)

**N73-33505#** Los Alamos Scientific Lab., N.Mex.

**PARTICULATE COMPOSITE MATERIALS TECHNOLOGY**

R. E. Riley and J. M. Taub May 1973 9 p refs

(Contract W-7405-eng-36)

(LA-5173) Avail: NTIS HC $4.00

Data are presented on various composite materials studied at LASL. The materials include W-Ni-Fe alloys without and with Re (mechanical properties and microstructure); ZrO2-ZrC, UO2-ZrC, UO2-HfC, and HfO2-HfC composites (thermal conductivity); TaC-NbC-C composites (flexure strength and thermal shock rating); and Cu-B4C sheet (relative neutron absorber effectiveness). NSA

**N73-33506#** Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

**STUDY OF THE ELECTRONIC AND MAGNETIC PROPERTIES OF SOME ACTINIDE COMPOUNDS BY SPECIFIC HEAT MEASUREMENTS Ph.D. Thesis - Nancy Univ.**

J. Danan Jul. 1973 138 p refs In FRENCH

(CEA-R-4453) Avail: AEC Depository Libraries HC $9.00

A calorimeter is described that measures specific heat between 1.5 and 300 K with a precision of 1%. Carbides, nitrides, and sulfides of uranium and thorium were studied. The radioactive compound Pu2C3 was also studied. The specific heat of the uranium compounds was calculated from those of the isomorphous thorium compounds by the corresponding states method. The analysis of the magnetic and electronic specific heat of the uranium compounds showed that a localized 5f2 configuration model does not correctly describe the phenomena in the case of the carbides and nitrides, but one cannot discard it in first approximation in the case of the sulfides, where it explains most of the magnetic properties. Author (NSA)

**N73-33507#** Oak Ridge National Lab., Tenn.

**APPLICATION OF FRACTURE MECHANICS TO GRAPHITE UNDER COMPLEX STRESS CONDITIONS**

G. T. Yahr and R. S. Valachovic 1972 11 p refs Sponsored by AEC

(Conf-730707-2) Avail: NTIS HC $3.00

The applicability of linear elastic fracture mechanics to graphite

under multiaxial stress conditions is examined. The study is extended to consider combined stress states. The specimens used were thick-walled graphite cylinders with flat heads that were internally pressurized. Two series of specimens were used. The first series had complete circumferential notches machined diagonally into the head-cylinder juncture region while the second series was unnotched. The methods of linear elastic fracture mechanics and a finite element analysis were used to predict pressures to cause fracture for both notched and unnotched specimens. In the latter case, it was necessary to postulate a size for a naturally occurring flaw. These predicted pressures were in good agreement with measured values. Author (NSA)

**N73-33508#** Air Force Systems Command, Wright-Patterson AFB, Ohio.
**HIGH-MELTING OXIDE AND CARBIDE**
V. G. Gordon, A. B. Ivanov, B. V. Lukin, V. A. Nikolayeva, V. A. Petrov, A. I. Rekov, V. Ye. Serebrennikova, E. G. Spiridonov, G. I. Stavrovskiy, and L. I. Fedotova 31 Jul. 1973 29 p refs Transl. into ENGLISH from the publ. "Electricity from MHD" Warsaw, IAEA, 1968 p 3031-3058 Presented at Symp. on Magnetohydrodyn. Elec. Power Generation, Warsaw, 1968
(AD-764969; FTD-MT-24-770-73) Avail: NTIS CSCL 10/2

High melting oxide and carbide materials in the electrode walls of MHD generators are discussed. On the basis of an analysis of operating conditions in a MHD generator, channel requirements for materials and the construction of electrode walls are formulated and the fundamental characteristics of materials leading to operational dependability of the channel are determined. The general laws governing the variation in the structure and properties in the MHD generator channel were established. The role of dislocations and microdefects as the foci of the breakdown of silicon carbide was detected. Results show that a welded joint of carbides with stainless steel possesses sufficient strength, and the use of welding for joining electrodes with current leads makes it possible to obtain minimum contact resistance. Author

**N73-33509#** Air Force Systems Command, Wright-Patterson AFB, Ohio.
**MANUFACTURE OF MULTICOLOR ELECTROLUMINESCENT CHIPS**
B. L. Antipov, O. A. Izumrudov, N. P. Lazareva, and G. A. Savelev 18 Jul. 1973 9 p refs Transl. into ENGLISH from Izv., Electrotech. Inst. USSR (Leningrad), no. 108, 1972 p 175-179
(AD-764943; FTD-HT-23-792-73) Avail: NTIS CSCL 11/7

A photographing method for the manufacturing of multicolor electroluminescent chips was developed. The main difficulty in the manufacturing was the necessity to individually place the phosphers with different colors of luminescence on the base and independently switch them with the respective voltage.
Author

**N73-33510#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**APPARATUS FOR THERMOMECHANICAL SURFACE TREATMENT OF ORGANIC GLASS, ITS EFFECT, INSTRUCTIONS AND PRACTICAL TESTING**
N. V. Skripnik, B. N. Blinov, and V. I. Prosvnrin 30 Jul. 1973 18 p Transl. into ENGLISH from Eksplutatsionnaya Nadezhnost, Kachestvo i Svoistva Samoletnogo Organicheskogo Stekla (USSR), no. 177, 1971 p 79-93
(AD-764972; FTD-MT-24-438-73) Avail: NTIS CSCL 11/2

In designing equipment which removes the silver (crazing) on aircraft glass one must consider that such operations will be performed under civil aviation repair shop conditions as well as airport conditions. For this reason two items were designed: one with an electrical drive, which is intended for repair shop conditions; one with a pneumatic drive, intended for both airport conditions and repair shop conditions. GRA

**N73-33511#** Pennsylvania State Univ., University Park. Materials Research Lab.
**GLASSY CARBON, ALLOYS Semiannual Technical Report, 1 Jan. - 30 Jun. 1973**
P. L. Walker, Jr. 27 Jul. 1973 76 p refs
(Contract DAHC15-71-C-0290)
(AD-764918) Avail: NTIS CSCL 11/2

Work was performed in the following areas: Compositional and structural modification of glassy carbon by addition of iron; Spherulitic glassy carbon; Infiltration of glassy carbons with open macroporosity with CVD carbon; Laser Raman studies on carbons; and Preparation and characterization of binary carbon-based glasses by RF-sputtering. GRA

**N73-33512#** Defense Documentation Center, Alexandria, Va.
**MANUFACTURING METHODS OF COMPOSITE MATERIALS Report Bibliography, Apr. 1963 - Mar. 1973**
Jul. 1973 134 p refs
(AD-764600; DDC-TAS-73-44) Avail: NTIS CSCL 11/4

The bibliography contains unclassified and unlimited references on manufacturing methods of composite materials such as fabrication techniques and fiber forming. Corporate Author-Monitoring Agency, Subject, Title, and Personal Author Indexes are included. Author GRA

**N73-33196** Lutravil Spinnvlies G.m.b.H. and Co., Kaiserslautern (West Germany).
**STRUCTURE OF AERODYNAMICALLY SPUN NON-WOVEN FABRICS [ZUR STRUKTUR AERODYNAMISCH GESPONNENER FASERVLIESE]**
Lueder Gerking *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Part 1 9 Mar. 1972 p 141-153 refs In GERMAN; ENGLISH summary (For availability see N73-33186 24-12)

# 19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

**N73-33513#** Nauka Press, Moscow (USSR).
**PLANNING OF AN EXPERIMENT IN CONDITIONS OF HETEROGENEITY [PLANIROVANIYE EKSPERIMENTA V USLOVIYAKH NEODNORODNOSTEY]**
Ye. V. Markova and A. N. Lisenkov 1973 219 p refs In RUSSIAN
Avail: NTIS HC $13.00

One of the subdivisions of the theory of multifactor experiments is considered, which is the methodology of planning an experiment under nonuniform conditions. Methods of planning are described in detail, as well as: (1) the evaluation of the effect of discrete drift with a combinatorial scheme of the Latin type, (2) hyper-Greek-Latin squares, right angles, and cubes, (3) BIB and PBIB schemes, (4) complex nonsymmetric plans, and (5) problems of utilizing combinatorial schemes for constructing second-order plans and a subsequent filtering experiment. Methods are outlined for planning under conditions of constant drift. The planning methods are represented as special procedures with bounds on the randomization of the conditions under which the experiment is conducted. Transl. by K.P.D.

**N73-33514#** Academy of Sciences (USSR), Moscow.
**PROBLEMS OF CYBERNETICS. PROBLEMS OF RANDOM SCANNING [VOPROCY KIBERNETIKI. PROBLEMY SLUCHAYNOGO POISKA]**
S. I. Samoylenko 1973 73 p refs In RUSSIAN
Avail: NTIS HC $5.75

Random walks are considered in relation to search optimization and function space. Optimization of independent automata, smoothing methods, and the development of random walks algorithms are also discussed. Topics also presented are the use of otpimal methods of extremum location, application of Markov chains for search analysis, information theory and statistical approaches to algorithm construction, and the synthesis of electronic devices using search optimization. Transl. by K.P.D.

**N73-33515#** Nauka Press, Moscow (USSR).
**LINEAR AND NONLINEAR SYSTEMS [LINEYNYYE I NELINEYNYYE SISTEMY]**
A. A. Kharkhevich 1973 566 p refs In RUSSIAN
Avail: NTIS HC $30.50

Investigation are considered which are devoted to the analysis of linear systems, the determination of their particular characteris-

tics, and the evaluation of distortion on the basis of quadratic criteria. Extensive work is included in the area of nonlinear and parametric phenomena in radio technology and the theory and practice of the spectral analysis of perturbations.
Transl. by K.P.D.

**N73-33516*#** Alabama Univ., Huntsville.
**MATHEMATICAL RESEARCH ON SPLINE FUNCTIONS Final Report**
James M. Horner Sep. 1973 51 p refs
(Contract NAS8-27181)
(NASA-CR-124454; UAH-RR-148) Avail: NTIS HC $4.75 CSCL 12A

One approach in spline functions is to grossly estimate the integrand in J and exactly solve the resulting problem. If the integrand in J is approximated by Y' squared, the resulting problem lends itself to exact solution, the familiar cubic spline. Another approach is to investigate various approximations to the integrand in J and attempt to solve the resulting problems. The results are described. Author

**N73-33517*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**ROUND-OFF ERRORS IN CUTTING PLANE ALGORITHMS BASED ON THE REVISED SIMPLEX PROCEDURE**
John Edd Moore Washington Oct. 1973 33 p refs
(NASA-TN-D-7457; M-117) Avail: NTIS HC $3.00 CSCL 12A

This report statistically analyzes computational round-off errors associated with the cutting plane approach to solving linear integer programming problems. Cutting plane methods require that the inverse of a sequence of matrices be computed. The problem basically reduces to one of minimizing round-off errors in the sequence of inverses. Two procedures for minimizing this problem are presented, and their influence on error accumulation is statistically analyzed. One procedure employs a very small tolerance factor to round computed values to zero. The other procedure is a numerical analysis technique for reinverting or improving the approximate inverse of a matrix. The results indicated that round-off accumulation can be effectively minimized by employing a tolerance factor which reflects the number of significant digits carried for each calculation and by applying the reinversion procedure once to each computed inverse. If 18 significant digits plus an exponent are carried for each variable during computations, then a tolerance value of 0.1 x 10 to the minus 12th power is reasonable. Author

**N73-33518#** Royal Aircraft Establishment, Farnborough (England). Structures Dept.
**THE PREDICTION OF INSTABILITIES OF LINEAR DIFFERENTIAL EQUATIONS WITH PERIODIC COEFFICIENTS**
R. J. Davies London Aeron. Res. Council 1973 34 p refs
Supersedes RAE-TM-Struct-794; ARC-33260; RAE-TR-67161; ARC-29
(ARC-R/M-3713; RAE-TM-Struct-794; ARC-33260; RAE-TR-67161; ARC-29) Avail: NTIS HC $3.75; HMSO £1.32; PHI $5.30

The stability of the solutions of a system of differential equations with periodic coefficients has been examined using Floquet's theorem and a general method of solution has been programmed in ICL 1900 FORTRAN. The application of the method is illustrated by the solution of two dynamical systems, both of which are unsymmetrical rigid rotors in unsymmetrical bearings, and the program has been used to obtain solutions for up to six simultaneous second-order differential equations with periodic coefficients. Author (ESRO)

**N73-33519#** Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
**STOCHASTIC PROCESSES AND DYNAMIC SYSTEMS [PROCESSUS STOCHASTIQUES ET SYSTEMES DYNAMIQUES]**
J. Aguilar-Martin Mar. 1973 87 p refs In FRENCH
(LAAS-AS-73-I-09) Avail: NTIS HC $6.50

Stochastic processes and dynamic systems are reviewed. Definitions and theorems are given with regard to the following topics: probability space, real value random variables, induced probability and density, conditional probability, independence, moments and expectations, and multivariable laws, random Gaussian variables and transformation, stochastic processes, time dependance, second order transitive description of stochastic processes, and conditional transition probabilities, linear projection and prediction, optimal linear projection, and linear conditional expectation, strict and loose Markovian processes, Gauss-Markov equation linear differential systems and loose Markov processes, orthogonal increment processes, Brownian movement, Ito stochastic integral, and Ito processes. ESRO

**N73-33520#** Hughes Aircraft Co., Fullerton, Calif. Systems Effectiveness Dept.
**BAYESIAN RELIABILITY DEMONSTRATION: PHASE 3 - DEVELOPMENT OF TEST PLANS Final Technical Report, Oct. 1971 - Mar. 1973**
R. E. Schafer, T. S. Sheffield, and J. R. Collins Jun. 1973 195 p refs
(Contract F30602-72-C-0067)
(AD-765172; RADC-TR-73-139) Avail: NTIS CSCL 12/1

The study is the third phase of a three phase effort to develop Bayesian Reliability Demonstration Tests (BRDT). The objectives of this phase were: Develop and tabulate BRDT of fixed time and sequential types; Develop and tabulate tests (called Bayes/Classical in this report) when the producer and consumer cannot agree on a prior distribution; Develop methods of updating existing prior distributions; Develop a preliminary military standard for BRDT; Investigate some special problems; Fit additional prior distributions. Bayesian fixed times tests, Bayesian/Classical fixed time tests, and Sequential Bayesian tests were developed and tabulated. These tests form an essential part of the preliminary military standard which was also developed. Additional fits of the inverted gamma distribution reconfirmed its choice as a prior distribution and further study showed that updates in the prior distribution are easily made. A test based on probability of acceptance is satisfactory to test for shifts in the prior distribution. Tables were developed giving the truncation points for the sequential tests. At this time, no satisfactory solution has been found for placing more than one equipment on test at a time. Author (GRA)

# 20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

**N73-33521** New York Univ., N.Y.
**ASYNOPTIC METEOROLOGICAL DATA ASSIMILATION BY MEANS OF TIME-COORDINATE TRANSFORMATION Ph.D. Thesis**
Isidore M. Halberstam 1973 90 p
Avail. Univ. Microfilms Order No. 73-19390

A method for using large quantities of asynoptic data is proposed. The method is based on a transformation of the time coordinate to coincide with the satellite paths, and a set of transformed equations is used to predict beyond the time of data acquisition. Simulated barotropic forecasts based on the proposed technique are compared with forecasts which are updated by direct insertion of data. Results indicate that the proposed method functions well provided the asynoptic data are received in a fairly continuous fashion, cover the entire field, and are of better quality cessible synoptic observations.
Dissert. Abstr.

**N73-33522#** Joint Publications Research Service, Arlington, Va.
**ANALYSIS OF METEOROLOGICAL CONDITIONS FOR AVIATION**
K. G. Abramovich, ed. 25 Sep. 1973 69 p refs Transl. into ENGLISH of the publ. "Analiz Meteorologicheskikh Usloviy dlya Aviatsii" Leningrad, Gidrometeoizdat, 1972 63 p
(JPRS-60114) Avail: NTIS HC $5.50

Results are presented of studies conducted on weather phenomena which can limit aircraft landings and flights along air lanes. The effects of the spatial variability of the wind in the

stratosphere on the accuracy of maintaining a flight trajectory by a supersonic transport at a given altitude are also discussed. For individual titles, see N73-33523 through N73-33529.

**N73-33523** Joint Publications Research Service, Arlington, Va.
**ANALYSIS OF VISIBILITY CONDITIONS WHEN LANDING AN AIRCRAFT IN A RADIATION FOG**
Yu. G. Konovalov and M. Ya. Ratsimor *In its* Analysis of Meteorol. Conditions for Aviation (JPRS-60114) 25 Sep. 1973 p 2-8 refs Transl. into ENGLISH from the publ. "Analiz Meteorologicheskikh Usloviy dlya Aviatsii" Leningrad, Gidrometeoizdat, 1972 p 3-9 (For availability see N73-33522 24-20)

A procedure is presented for calculating the slant visibility range of ground objects for transparency of the atmosphere which is different with respect to altitude. The calculations were performed for a two-layer atmosphere: the layer of radiation fog and the layer above with relatively high transparency. It was demonstrated that the significant altitude of detection of the ground objects during observation at a high angle to the horizon can confuse the pilot of an aircraft making the approach for a landing with respect to visibility conditions when descending into a layer of fog. Author

**N73-33524** Joint Publications Research Service, Arlington, Va.
**EXPERIMENT IN OBJECTIVIZATION OF THE METHOD OF FORECASTING THE ALTITUDE OF THE LOWER CLOUD BOUNDARY**
K. G. Abramovich and M. V. Rubinshteyn *In its* Analysis of Meteorol. Conditions for Aviation (JPRS-60114) 25 Sep. 1973 p 9-16 refs Transl. into ENGLISH from the publ. "Analiz Meteorologicheskikh Osloviy dlya Aviatsii" Leningrad, Gidrometeoizdat, 1972 p 9-16 (For availability see N73-33522 24-20)

A procedure is described for developing the objective method of forecasting the altitude of the lower cloud boundary using a statistical sort of the most informative predictors and calculating the regression coefficients. The problem of the methods of approximation of the results obtained, to the aviation demands, is discussed. Author

**N73-33525** Joint Publications Research Service, Arlington, Va.
**TURBULENCE NEAR THE TROPOPAUSE IN THE PRESENCE OF HIGH ALTITUDE WAVES**
G. S. Buldovskiy *In its* Analysis of Meteorol. Conditions for Aviation (JPRS-60114) 25 Sep. 1973 p 17-27 refs Transl. into ENGLISH from the publ. "Analiz Meteorologicheskikh Usloviy dlya Aviatii" Leningrad, Gidrometeoizdat, 1972 p 17-27 (For availability see N73-33522 24-20)

A study was made of the distribution of the recurrence rate of cases of buffeting of different intensity in the troposphere, the layer of the tropopause and the lower stratosphere (to 18km) under the conditions of high altitude waves. It was established that for the occurrence of moderate or severe turbulence near the tropopause, in addition to the high altitude waves it is necessary also to have significant vertical shifts of the wind vector, usually observed near the maximum in the vertical profile of the wind velocity. The probability of turbulence near the tropopause is greater, the deeper the inversion in the tropopause layer. An analysis was made of the data of individual flights under the conditions of high altitude waves. Author

**N73-33526** Joint Publications Research Service, Arlington, Va.
**RELATION OF CLEAR AIR TURBULENCE TO EVOLUTION OF THE BARIC FIELD**
A. A. Vasilyev *In its* Analysis of Meteorol. Conditions for Aviation (JPRS-60114) 25 Sep. 1973 p 28-36 refs Transl. into ENGLISH from the Publ. "Analiz Meteorologicheskikh Usloviy dlya Aviatsii" Leningrad, Gidrometeoizdat, 1972 p 27-35 (For availability see N73-33522 24-20)

On the basis of turbulence reports received from airline pilots for a 10-day period (11-20 March 1969) it was established that the effect of the evolution of the baric field at the earth's surface on the variation of the probability of clear air turbulence is insignificant. A significant increase in probability occurs only for flights above the atmospheric fronts. The dependence of the probability of CAT on the variation of the geopotential altitude near the flight level was detected; however, it was ambiguous and was determined by the form of the synoptic model. Author

**N73-33527** Joint Publications Research Service, Arlington, Va.
**ANALYSIS OF CASES OF SEVERE TURBULENCE IN THE TROPOSPHERE**
A. A. Vasilyev and N. N. Chuchkalova *In its* Analysis of Meteorol. Conditions for Aviation (JPRS-60114) 25 Sep. 1973 p 37-44 refs Transl. into ENGLISH from the publ. "Analiz Meteorologicheskikh Usloviy dlya Aviatsii" Leningrad, Gidrometeoizdat, 1972 p 37-44 (For availability see N73-33522 24-20)

A study was made of the distribution of the cases of turbulence with respect to altitudes, seasons, flight conditions, and the horizontal extent of the zones of severe turbulence. An analysis was made of the meteorological conditions of the development of severe turbulence in the troposphere recorded by the K3-63 pen recorder installed on the IL-18 civil aircraft. It was established that most frequently the severe turbulence was encountered in cases where the meteorological conditions were characterized by a combination of several attributes favorable for its occurrence. Author

**N73-33528** Joint Publications Research Service, Arlington, Va.
**CONDITIONS OF ICING OF MODERN TRANSPORT AIRCRAFT FROM ROUTINE FLIGHT DATA**
O. K. Trunov and S. P. Khachatryan *In its* Analysis of Meteorol. Conditions for Aviation (JPRS-60114) 25 Sep. 1973 p 45-51 refs Transl. into ENGLISH from the publ. "Analiz Meteorologicheskikh Usloviy dlya Aviatsii" Leningrad, Gidrometeoizdat, 1972 p 45-51 (For availability see N73-33522 24-20)

The results of analyzing the statistical data on the icing conditions of modern transport aircraft completing flights from Moscow along the international air lane are presented. A study was made of the data on the recurrence rate of the icing zones as a function of the air temperature, the flight altitude, the form of the clouds, the time of year also the extent of the icing zones and the intensity of icing of the aircraft. Author

**N73-33529** Joint Publications Research Service, Arlington, Va.
**ADMISSIBLE SCALE OF SPATIAL AVERAGING OF THE VALUES OF THE GEOPOTENTIAL IN THE STRATOSPHERE CONSIDERING THE EFFECT OF THE WIND ON THE FLIGHT OF A SUPERSONIC AIRCRAFT**
S. V. Solonin and G. I. Mazurov *In its* Analysis of Meteorol. Conditions for Aviation (JPRS-60114) 25 Sep. 1972 p 52-61 refs Transl. into ENGLISH from the publ. "Analiz Meteorologicheskikh Usloviy dlya Aviatsii" Leningrad, Gidrometeoizdat, 1972 p 52-61 (For availability see N73-33522 24-20)

A study was made of the effect of the spatial variability of the wind in the stratosphere on the accuracy of maintaining the flight trajectory of a supersonic transport (SST) at a given altitude. On the basis of simulating the flights with different supersonic velocities on the level of the 100 millibar isobaric surface, admissible scales of spatial averaging of the data on the baric field were established as a function of the significance of the air space. The accuracy of maintaining the given route under different aerosynoptic conditions when using integral corrections is analyzed. The conclusion is drawn regarding the admissible scales of spatial averaging of the values of the geopotential for meteorological servicing of the SST flights. Author

**N73-33530#** Joint Publications Research Service, Arlington, Va.
**METEOROLOGY AND HYDROLOGY, NO. 7, 1973**
28 Sep. 1973 103 p Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973
(JPRS-60164) Avail: NTIS HC $7.25

Articles are presented concerning microclimatology, agricultural meteorology, weather forecasting, weather modification, and hydrological forecasting. For individual titles, see N73-33531 through N73-33538.

**N73-33531** Joint Publications Research Service, Arlington, Va.
**AN EXACT SOLUTION TO THE SYSTEM OF FORECASTING EQUATIONS OF THE BAROTROPIC-DIVERGENT MODEL OF THE ATMOSPHERE**
A. I. Burtsev *In its* Meteorol. and Hydrol., No. 7, 1973, (JPRS-60164) 28 Sep. 1973 p 1-12 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 3-12 (For availability see N73-33530 24-20)

The derivation of the exact solution of the system of nonlinear

forecasting equations is presented for the mean level of the atmosphere under the assumption that in the vincinity of the calculated point the Coriolis parameter is a constant, and the wind and geopotential fields are approximated by linear and quadratic functions respectively. An analysis of the solution obtained is presented, and the possible areas of its application are discussed. Author

**N73-33532** Joint Publications Research Service, Arlington, Va.
**INTERNAL WAVES IN STRATIFIED FLOWS**
Z. N. Kogan *In its* Meteorol. and Hydrol., No. 7, 1973 (JPRS-60164) 28 Sep. 1973 P 13-26 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 13-23 (For availability see N73-33530 24-20)

The results of the numerical solution of the problem of the gravitational-shear waves in a flow with an arbitrary temperature stratification are discussed. A detailed study was made of a case of a jet stream near the tropopause. The distribution of the wave amplitudes with respect to the altitude highly dependent on the type of tropopause, its arrangement with respect to the maximum wind level, and the thermal stratification under the tropopause. Author

**N73-33533** Joint Publications Research Service, Arlington, Va.
**STRUCTURE OF GLOBAL GEOPOTENTIAL FIELDS IN CONNECTION WITH THE QUASI-BIANNUAL CYCLICITY IN THE EQUATORIAL STRATOSPHERE** c13
A. A. Pavlovskaya *In its* Meteorol. and Hydrol., No. 7, 1973 (JPRS-60164) 28 Sep. 1973 p 27-41 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 24-35 (For availability see N73-33530 24-20)

On the basis of the mean monthly AT sub 30 and AT sub 50 world maps first constructed separately for the two years of easterly and westerly circulation in the equatorial stratosphere, some peculiarities of the global geopotential and circulation field were discovered. Maps were constructed of the interphase differences of the geopotential, and the global nature of the appearance of the quasi two-year cyclicity was demonstrated in the field of values of H. The structure of the baric field in the tropical and equatorial stratosphere is more precisely defined in the schemes for the horizontal global circulation during the periods of different phases of the quasi-biannual cycle. Author

**N73-33534** Joint Publications Research Service, Arlington, Va.
**NONLINEAR METHODS OF EVALUATING THE INFORMATIVENESS OF METEOROLOGICAL PARAMETERS AND CLASSIFYING METEOROLOGICAL PHENOMENA (FUNCTIONAL METHODS AND ALGORITHMS)**
A. V. Timofeyev *In its* Meteorol. and Hydrol., No. 7, 1973 (JPRS-60164) 28 Sep. 1973 p 42-53 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 36-46 (For availability see N73-33530 24-20)

A study was made of nonlinear methods and algorithms for evaluating the informativeness of the meteorological parameters, selecting their optimal set and constructing the nonlinear separating functions insuring classification of the meteorological phenomena with given accuracy. The proposed methods are illustrated by the results of the solution of the problems of recognizing types of clouds and identifying hail clouds on a computer. Author

**N73-33535** Joint Publications Research Service, Arlington, Va.
**SPATIAL STRUCTURE OF TEMPERATURE FLUCTUATIONS IN THE SEA** c13
L. K. Kramareva *In its* Meteorol. and Hydrol., No. 7, 1973 (JPRS-60164) 28 Sep. 1973 p 54-61 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 55-60 (For availability see N73-33530 24-20)

A study was made of the spatial structure of temperature waves, and an analogy is drawn between them and the Rossby waves. This similarity offers the possibility of stating that the intramonthly water temperature fluctuations are caused primarily by Rossby waves, and they can serve as indicators of these waves. Author

**N73-33536** Joint Publications Research Service, Arlington, Va.
**SOME GAPS IN THE DEVELOPMENT OF HYDROMETEOROLOGICAL SCIENCE**
F. F. Davitaya *In its* Meteorol. and Hydrol., No. 7, 1973 (JPRS-6014) 28 Sep. 1973 p62-72 Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 87-96 (For availability see N73-33530 24-20)

Along with the progress in hydrometeorological science, the inadequate scale of scientific research and the existing deficiencies in the development of theoretical and practical problems in the field of agrometeorology and climatology are noted. That this imposes a significant loss of operative activity of the Hydrometeorological Service with respect to supplying the national economy with reliable forecasts and regime data is demonstrated. The scientific problems subject to solution in the near future are defined. Author

**N73-33537** Joint Publications Research Service, Arlington, Va.
**AUTOMATION OF THE PROCESSES OF GATHERING AND PRIMARY PROCESSING OF SCIENTIFIC INFORMATION ON THE EXPEDITIONS OF THE ARCTIC AND ANTARCTIC SCIENTIFIC RESEARCH INSTITUTE** c08
I. A. Dyubkin *In its* Meteorol. and Hydrol., No. 7, 1973 (JPRS-60164) 28 Sep. 1973 p 73-85 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 97-103 (For availability see N73-33530 24-20)

A brief survey is presented along with the results from the work done at the Arctic and Antarctic Scientific Research Institute on the automation of the processes of gathering and primary processing of hydrometeorological information on the institute expeditions. Estimates are made of the efficiency of the introduced methods of automated processing of hydrometeorological information. Author

**N73-33538** Joint Publications Research Service, Arlington, Va.
**HYDROLOGIC RESEARCH IN REPRESENTATIVE AND EXPERIMENTAL RIVER BASINS** c13
K. P. Voskresenskiy *In its* Meteorol. and Hydrol., No. 7, 1973 (JPRS-60164) 28 Sep. 1973 p 86-92 Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 7, 1973 p 112-115 (For availability see N73-33530 24-20)

A review is presented of the basic reports given at the symposium in Wellington, New Zealand in 1970. Author

**N73-33539#** National Oceanic and Atmospheric Administration, Boulder, Colo. Experimental Meteorology Lab.
**CUMULUS CLOUDS AND THEIR MODIFICATION**
Joanne Simpson and Arnett S. Dennis (S. Dakota School of Mines and Technol.) May 1972 153 p refs
(NOAA-TM-ERL-OD-14) Avail: NTIS HC $9.75

The modification of cumulus clouds is discussed in the framework of their importance to the energetics and transports of the large-scale atmosphere, as well as that of their role in precipitation production and water management. The various attempts at enhancing coalescence are described, including use of water spray, hygroscopic materials and electric fields. The material concerns seeding supercooled cumuli with dry ice and silver iodide, beginning with the basic principles and methods used. Distinction is made between the static and dynamic approaches. Other cumulus modification methods, actual and potential, are summarized, including radiative alterations, carbon black), boundary layer modifications (such as asphalt coatings) and fires. All of these methods are in their infancy regarding demonstration of success and usefulness. Possible extended area and persistence effects of cumulus modification are suggested as well as potential ways of documenting these largely unknown interactions. The potential impacts of cumulus alteration on synoptic and larger-scale weather systems are speculated upon and the apparently most promising areas of future investigation outlined. Author

**N73-33540#** Japan Meteorological Agency, Tokyo.
**AEROLOGICAL DATA OF JAPAN, NOVEMBER 1972**
1973 303 p refs
Avail: NTIS HC $17.25

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, pilot-balloon data, and rocketsonde data. Author

**N73-33541#** Japan Meteorological Agency, Tokyo.
**AEROLOGICAL DATA OF JAPAN, JANUARY 1973**
1973 315 p refs
Avail: NTIS HC $17.75

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, pilot-balloon data, and rocketsonde data. Author

**N73-33542*#** Kansas Univ. Center for Research, Inc., Lawrence.
**A NONCOHERENT MODEL FOR MICROWAVE EMISSIONS AND BACKSCATTERING FROM THE SEA SURFACE**
S. T. Wu and A. K. Fung Washington NASA Nov. 1973 36 p refs
(Contract NAS1-10048)
(NASA-CR-2326; TR-186-3) Avail: NTIS HC $3.00 CSCL 20N

The two-scale (small irregularities superimposed upon large undulations) scattering theory proposed by Semyonov was extended and used to compute microwave apparent temperature and the backscattering cross section from ocean surfaces. The effect of the small irregularities upon the scattering characteristics of the large undulations is included by modifying the Fresnel reflection coefficients; whereas the effect of the large undulations upon those of the small irregularities is taken into account by averaging over the surface normals of the large undulations. The same set of surface parameters is employed for a given wind speed to predict both the scattering and the emission characteristics at both polarizations. Author

**N73-33543*#** Kansas Univ. Center for Research, Inc., Lawrence.
**BACKSCATTERING FROM A TWO-SCALE ROUGH SURFACE WITH APPLICATION TO RADAR SEA RETURN**
H. L. Chan and A. K. Fung Washington NASA Nov. 1973 69 p refs
(Contract NAS1-10048)
(NASA-CR-2327; TR-186-4) Avail: NTIS HC $3.50 CSCL 20N

A two-scale composite surface scattering theory was developed without using the noncoherent assumption. The surface is assumed electrically homogeneous and finintely conducting; the surface roughness may be nonuniform geometrically. The special forms of the terms for excluding the non-coherent assumption and the meanings of these terms are discussed. To gain insight into the mechanisms of backscattering, the results are compared with those obtained by previous theories. The comparison with NRL data shows satisfactory agreement for both horizontal and vertical polarization, especially for incident angles larger than 30 deg. For smaller incident angles, NASA/JSC data have been chosen for comparison and close agreement is again observed. Author

**N73-33544#** Texas Univ., Austin. Atmospheric Science Group.
**ANALYSIS OF LOWER TROPOSPHERIC WINDS OBSERVED ALONG THE UPPER TEXAS COAST, 25 MAY - 15 JUNE 1966**
F. M. Haase and Kenneth H. Jehn Jun. 1973 99 p refs
(Grant NSF GA-16167)
(Rept-35) Avail: NTIS HC $7.00

From pilot balloon observations of the wind along the upper Texas coast in May-June 1966 at intervals varying from 30 minutes to 3 hours, it was found that either a sea/land breeze circulation or a low level jet dominated the atmospheric flow below about 6,000 feet above ground. Rarely did a day with a low level jet development also have an identifiable sea breeze. Occurrences of a low level jet were associated with the passage over the southern plains of short waves in the westerlies. A day with a low level jet usually exhibited a wind maximum near midnight, while a day with a sea breeze had the strongest surface winds in late afternoon. Author

**N73-33545#** World Meteorological Organization, Geneva (Switzerland).
**THE FIRST GARP GLOBAL EXPERIMENT. OBJECTIVES AND PLANS**
Mar. 1973 144 p refs Prepared jointly with Intern. Council of Sci. Unions, Rome
(GARP-Publ-11) Avail: NTIS HC $9.25; WMO, Geneva

Concepts and subsystems of the global weather observation experiment are outlined and digital techniques for meteorological data processing and numerical weather forecasting are discussed. For individual titles, see N73-33546 through N73-33549.

**N73-33546** National Environmental Satellite Service, Washington, D.C.
**WIND ESTIMATION BY TRACKING CLOUDS ON IMAGES FROM GEOSYNCHRONOUS SATELLITES**
Lester F. Hubert *In* WMO The first GARP Global Expt.: Objectives and Plans Mar. 1973 p 69-73 refs (For availability see N73-33545 24-20)

Characteristics of satellite wind data are determined by measurements on selected cloud patterns. Data quality depends upon success in selecting appropriate clouds, measuring their displacements and determining their height. Substantial improvements in measurement are achieved by the addition of infrared measurements on the Synchronous Meteorological Satellite (SMS). ESRO

**N73-33547** Laboratoire de Meteorologie Dynamique, Paris (France).
**THE CONSTANT-LEVEL BALLOON SUB-SYSTEM: THE EOLE EXPERIMENT**
Paul Sitbon *In* WMO The first GARP Global Expt.: Objectives and Plans Mar. 1973 p 74-79 refs (For availability see N73-33545 24-20)

The Eole experiment, consisting of launching, interrogating, and tracking by satellite 500 constant-level balloons in the Southern Hemisphere lower stratosphere, is described and compared with other techniques. The Eole ballons, sensors, and location accuracy are discussed and their roles in atmospheric circulation noted. ESRO

**N73-33548** National Center for Atmospheric Research, Boulder, Colo.
**THE CARRIER-BALLOON - OMEGA DROPSONDE SUB-SYSTEM FOR THE GLOBAL EXPERIMENT**
V. E. Lally *In* WMO The first GARP Global Expt.: Objectives and Plans Mar. 1973 p 80-82 (For availability see N73-33545 24-20)

The concept of using balloons to carry dropsondes to obtain meteorological data is described, whereby such dropsondes use the Omega navigation system to allow information on wind determination in the tropical stratosphere to be obtained. ESRO

**N73-33549** World Meteorological Organization, Geneva (Switzerland).
**THE DATA PROCESSING FOR THE GLOBAL EXPERIMENT**
V. G. Boldirev *In* the first GARP Global Expt.: Objectives and Plans Mar. 1973 p 90-107 (For availability see N73-33545 24-20)

Information on data processing for each of the major observing sub-systems of the global experiment is presented. The general framework of the processing schemes is given as well as the volume of data flowing in each chain. The sub-system included are: surface-based World Weather Watch (WWW) networks, polar orbiting satellites, geostationary satellites, and special observing platforms. ESRO

**N73-33550#** World Meteorological Organization, Geneva (Switzerland).
**TENTH ANNIVERSARY OF THE WORLD WEATHER WATCH**
1973 60 p refs Presented at the 24th WMO Executive Comm. Meeting, Geneva, 26 May 1972
(WMO-342) Avail: NTIS HC $5.00

The origin of the World Weather Watch (WWW) is outlined along with its fundamental concept - consolidating the entire work of the weather service on an international scale. The future development of the WWW is also considered. The impact of outer space technology on developments in meteorology is analyzed by comparing predictions made in 1962 with current achievements. Finally the past, present, and future of numerical

weather prediction within the WWW is discussed. For individual titles, see N73-33551 through N73-33553.

**N73-33551** World Meteorological Organization, Geneva (Switzerland).
**THE ORIGIN OF THE WORLD WEATHER WATCH AND ITS FUTURE PROSPECTS**
V. A. Bugaev *In its* Tenth Anniv. of the World Weather Watch 1973 p 1-10 (For availability see N73-33550 24-20)

The origin of the World Weather Watch (WWW) and its subsequent development is outlined. The fundamental concept of WWW, consolidating the entire work of the weather service on an international scale, is considered. The future prospects of the WWW are discussed, emphasizing the role of meteorological satellites and the potential assistance of the Global Atmospheric Research Program. ESRO

**N73-33552** World Meteorological Organization, Geneva (Switzerland).
**THE IMPACT OF OUTER-SPACE TECHNOLOGY ON DEVELOPMENTS IN METEOROLOGY**
David S. Johnson *In its* Tenth Anniv. of the World Weather Watch 1973 p 11-32 (For availability see N73-33550 24-20)

In 1962 the World Meteorological Organization predicted a number of major contributions space technology would make to meteorology. These predictions are reviewed and compared with actual achievements. Infrared observation of clouds at night is discussed. Satellite-borne radar for precipitation observation has not materialized, but in its place the passive microwave radiometer shows promise in detecting precipitation over oceans. Surface pressure measurements have not taken place, but surface temperature measurements have. Wind observations derived from satellite data were not foreseen in 1962. Predictions for 1982 regarding the role of meteorological satellites include geostationary and polar orbiting satellites which will automatically derive wind data from cloud displacements and take temperature soundings to replace radiosondes. ESRO

**N73-33553** World Meteorological Organization, Geneva (Switzerland).
**NUMERICAL WEATHER PREDICTION WITHIN WORLD WEATHER WATCH: PAST, PRESENT AND FUTURE**
J. S. Sawyer *In its* Tenth Anniv. of the World Weather Watch 1973 p 33-44 refs (For availability see N73-33550 24-20)

The historical background to numerical weather forecasting is traced noting the various types of models and problems of data assimilation and analysis. Current practice in numerical weather forecasting is reviewed. Numerical forecasts of the pressure field for 24 hours are as good or better than any that can be produced by subjective methods, but there is uncertainty regarding predictability for periods for more than 3 days. One future development will be the use of even smaller mesh-lengths than any currently in use. ESRO

**N73-33554#** European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
**METEOROLOGICAL YEARBOOK, 13TH, 1971**
G. Bollini and C. Gandino Mar. 1973 72 p refs In ITALIAN (EUR-4943) Avail: AEC Depository Libraries HC $5.75

A description is presented of the methods for measuring and elaborating atmospheric phenomena. Many tables and graphs for the meteorological year 1971 are reported. Temperature measurements at screen no. 4, the flow of the Novellino book, and tables with the stability categories are included. Author (NSA)

**N73-33555#** European Atomic Energy Community, Brussels (Belgium).
**AIR LEAD CONCENTRATIONS IN THE EUROPEAN COMMUNITY Yearly Report, Apr. 1971 - Mar. 1972**
1973 167 p refs In ENGLISH, GERMAN, FRENCH, ITALIAN and DUTCH
(EUR-4982) Avail: AEC Depository Libraries HC $10.50

A first series of atmospheric lead measurements is presented, allowing an appreciation of the air lead levels in over 40 locations of the European Community and the United Kingdom. The measurements are a result of the various actions undertaken by the Commission in the past 18 months within the general framework of the program aimed at the reduction of air pollution by motor vehicles following the problems raised by the environmental health implications due to the presence of lead in the exhaust gases of such vehicles. Author (NSA)

**N73-33556#** National Oceanic and Atmospheric Administration, Las Vegas, Nev. Air Resources Lab.
**NUMERICAL PREDICTION OF THE MESOSCALE TRANSPORT OF ATMOSPHERIC EFFLUENTS: PHILOSOPHY AND MORPHOLOGY OF EXPERIMENTAL MODELS FOR PREDICTING THE WIND AND POTENTIAL RADIOLOGICAL FIELDS OVER THE NEVADA TEST SITE**
Darryl Randerson and John S. Cornett May 1973 61 p refs (AEC Order SF-54-351)
(NOAA-ARLV-351-28) Avail: NTIS HC $3.00

Two experimental numerical models are described and tentatively verified. One model predicts the mesoscale wind field over mountainous terrain and the other model forecasts the temporal and spatial changes in the airborne radioactivity field that might be associated with an accidental release of debris during nuclear testing on the Nevada Test Site. A mesoscale wind-prediction model is derived from the assumption of the conservation of vertical wind shear for a time period of at least 6 hr over an area 160 x 160 n mi. This assumption is closely analogous to the conservation of horizontal vorticity. Verification of the wind-prediction model is accomplished through two different modes. The model predicts the path of the debris cloud to be too far east by about 13 n mi, 2 hr after detonation, and by about 20 n mi, 3 hr after detonation. Above the 7000-ft level, the speed of movement of the cloud center is too fast by about 10 to 15 kt for a 3.5-hr forecast. Author (NSA)

**N73-33557#** World Meteorological Organization, Geneva (Switzerland).
**REPORT OF THE EIGHTH SESSION OF THE JOINT ORGANIZING COMMITTEE Global Atmospheric Research Program**
1973 129 p Conf. held at London, 14-19 Mar. 1973 Sci. Unions, Rome
Avail: NTIS HC $8.50

The activities of various programs of GARP are reported. These include the numerical experimentation program where the modeling aspect of GATE and observing system experiments were considered, the tropical experiment (GATE), and the AMTEX, JASIN, MONEX, and POLEX projects. The second GARP objective, that of climate, was discussed with emphasis on guiding principles and plan of action. The role of oceanographic programs in GARP was described. ESRO

**N73-33558#** Institut Royal Meteorologique de Belgique, Brussels.
**OPERATIONAL WEATHER SATELLITES [OPERATIONELE WEERSATELLIETEN]**
E. DeDycker and A. G. Maenhout 1973 45 p In DUTCH
(Publ-Ser-B-70) Avail: NTIS HC $4.25

Technological and operational aspects of meteorological satellites are surveyed. The survey includes orbital mechanics, radio communication with a satellite, radiation measurement with a satellite, the automatic picture transmission system, the programming of the antenna, and gridding. ESRO

**N73-33559#** Institut Royal Meteorologique de Belgique, Brussels.
**ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX. BULLETIN MENSUEL, AOUT. 1972]**
Aug. 1972 28 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
Avail: NTIS HC $3.50

Data obtained at Belgian weather stations for August 1972 are tabulated. The air pollution apparatus is briefly described. Author (ESRO)

**N73-33560#** Institut Royal Meteorologique de Belgique, Brussels.
**ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE Monthly Bulletin, Sep. 1972 [POLLUTION**

**ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX. BULLETIN MENSUEL, SEPTEMBER 1972]**
Sep. 1972 28 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
Avail: NTIS HC $3.50

Data obtained at Belgian weather stations are tabulated, and the air pollution apparatus is briefly described. ESRO

**N73-33561#** Institut Royal Meteorologique de Belgique, Brussels.
**CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Apr. 1973 [OBSERVATIONS CLIMATOLOGIQUES. BULLETIN MENSUEL, AVRIL 1973]**
Apr. 1973 15 p In FRENCH and DUTCH
Avail: NTIS HC $3.00

Meteorological parameters observed at different Belgian weather stations during April 1973 are given. ESRO

**N73-33562#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**NUMERICAL MODEL OF THE GENERAL CIRCULATION OF THE ATMOSPHERE ON A HEMISPHERE**
M. E. Shvets, L. R. Dmitriev-Arrago, and L. N. Magazenkov 31 Jul. 1973 63 p refs Transl. into ENGLISH from Tr. Glav. Geofiz. Obs. (Leningrad), no. 256, 1970 p 3-44
(AD-765544; FTD-MT-24-597-73) Avail: NTIS CSCL 04/2

The overall circulation in the Northern Hemisphere for the cold season is studied by means of a mathematical model. GRA

**N73-33563#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**HANDBOOK ON MONTHLY WEATHER FORECASTS, CHAPTERS 3, 4 AND 5**
N. A. Aristov and N. A. Bagrov 25 Jul. 1973 122 p Transl. into ENGLISH from the publ. "Rukovodstvo po Mesyachnym Prognozam Pogody" USSR, 1972 p 98-172
(AD-765607; FTD-MT-24-363-73) Avail: NTIS CSCL 04/2

Contents: Hydrodynamic method for monthly forecasts of meteorological fields; Statistical methods for the monthly forecast of meteorological fields; Synoptic methods of monthly weather forecasting. GRA

## 21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

**N73-33564** California Univ., Los Angeles.
**MODAL ANALYSIS FOR LIAPUNOV STABILITY OF ROTATING ELASTIC BODIES Ph.D. Thesis**
Andre Daniel Colin 1973 211 p
Avail: Univ. Microfilms Order No. 73-18621

The determination of the attitude stability of spinning elastic bodies is considered. A complete study of this problem requires in general two parallel investigations. In the first part, a modal analysis is accomplished for a class of special problems and finally, a derivation for literal attitude stability criteria for idealized spinning flexible spacecraft is performed. The modal analysis is accomplished for a class of structures idealized by beams or disks of small flexural rigidity. In the description of the flexible appendage, a continuous elastic axis are analyzed for a fully constrained base rotation. The study is specialized to the cases where the high spin rate is combined to the small flexural rigidity to produce a small parameter. The method of matched asymptotic expansions represents the general framework used in obtaining the solution for the several structures studied. Dissert. Abstr.

**N73-33565** Ohio State Univ., Columbus.
**CONSTRUCTION AND VALIDATION OF DECISION-THEORETIC MODELS OF LOW-LEVEL PILOTING AND NAVIGATIONAL BEHAVIOR Ph.D. Thesis**
Don Carl Hutcherson 1973 500 p
Avail: Univ. Microfilms Order No. 73-18907

An attempt was made to determine whether or not decision and value theory concepts can be used as elements of a model to explain the behavior of a military decision maker in the heat of battle, under severe time constraints, and in the face of the enemy. The decision task selected for analysis is that faced by a helicopter pilot in planning a route to be followed during an attack upon a target. The results indicate that considerable variation exists between subjects so that it may be impossible to develop a single route selection model that is completely acceptable to all individuals. However, the decision behavior of a predominant class of decision makers is apparently described to an acceptable degree by the route planning model, if the threat perception model known as Model One is used to measure perceived threat. Unfortunately, the model does not describe decision behavior equally well in all route selection situations. Furthermore, the data collected so far are not sufficient to determine whether or not the model can be used to predict the type of attack a decision maker will conduct in a specific situation. Dissert. Abstr.

**N73-33566** California Univ., Los Angeles.
**APPLICATION OF EXTENDED KALMAN FILTERING TO A DYNAMIC LABORATORY CALIBRATION OF AN INERTIAL NAVIGATION SYSTEM Ph.D. Thesis**
Frazier Jackson Hellings 1973 251 p
Avail: Univ. Microfilms Order No. 73-18631

A data reduction technique that obtains estimates of inertial sensor error model coefficients from a dynamic laboratory calibration of a typical interial navigation system is described. The error model coefficients are those associated with gyros, accelerometers, and their misalignment errors that have been found by test and analysis to be the predominant sources of error affecting system accuracy. The dynamic test procedure is obtained by command torquing the platform gyros to drive the platform through a prespecified torque profile so that each axis is subjected to the applied acceleration. Since the platform motion is a combination of commanded rate, applied earth-rate, and drift due to the gyro error terms, tracking the platform motion with Euler angle rates provides the basis for the state dynamics. Dissert. Abstr.

**N73-33567*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**IMP-J ATTITUDE CONTROL PRELAUNCH ANALYSIS AND OPERATIONS PLAN**
H. L. Hooper, J. B. McKendrew, and G. D. Repass Oct. 1973 78 p refs
(NASA-TM-X-70488; X-580-73-308) Avail: NTIS HC $6.00 CSCL 17G

A description of the attitude control support being supplied for the Explorer 50 mission is given. Included in the document are descriptions of the computer programs being used to support attitude determination, prediction, and control for the mission and descriptions of the operating procedures that will be used to accomplish mission objectives. Author

**N73-33568#** National Aviation Facilities Experimental Center, Atlantic City, N.J.
**EVALUATION OF LARGE SCREEN DISPLAY IN THE AUTOMATED OCEANIC ATC ENVIRONMENT Final Report, Jan. - Jul. 1973**
Anthony J. Spingola and Robert L. Giordano Oct. 1973 45 p refs
(FAA Proj. 102-150-020)
(FAA-ND-73-75; FAA-RD-73-136) Avail: NTIS HC $4.25

Tests were conducted utilizing a representative traffic sample within an ocean sector incorporating the northern half of the Oakland Flight Information Region (FIR). The large Screen Display (LSD) was evaluated as a subsystem of the Oceanic Air Traffic Control Experimental Automation System. All test subjects controlled the same traffic sample and performed all of the interactions appropriate to a normal ocean sector operation. The LSD was used to portray all the required oceanic ATC data. A questionnaire was completed by each test subject immediately after completion of each test. There was no intention to evaluate the automated functions as they existed in the experimental system, nor was any consideration given to the cost or technical aspects of this LSD. Analysis of controller questionnaire responses

indicates generally that the LSD was an acceptable method of displaying information; however, an individual cathode ray tube was preferred. Author

**N73-33569#** National Aviation Facilities Experimental Center, Atlantic City, N.J.
**OPERATIONAL EVALUATION OF THE ARTS 2 RADAR ALPHANUMERIC DISPLAY SUBSYSTEM (RADS)**
James F. Akers and Robert A. Clark Oct. 1973 27 p
(FAA Proj. 142-175-020)
(FAA-NA-73-77; FAA-RD-73-149) Avail: NTIS HC $3.50

A programmable, nontracking beacon Automated Radar Terminal System (ARTS II A) was installed in a TRACON configuration at the National Aviation Facilities Experimental Center. The operational suitability of the Radar Alphanumeric Display Subsystem (RADS) was evaluated. The RADS displays were evaluated over a 2-week period through the collection of subjective data obtained from controller questionnaires. It was concluded that the RADS consoles are suitable for use in air traffic control facilities. Modifications to the FOCUS control, MAP ILLUM control, A/N GAIN control, and Data Block Offset Switch are recommended. Author

**N73-33570#** Computer Sciences Corp., Falls Church, Va.
**STUDY OF OCEANIC AIRSPACE AND GROUND NETWORK CONFIGURATIONS IN SATELLITE SYSTEMS Final Report**
S. A. Klein Washington FAA Jul. 1973 203 p refs
(Contract DOT-FA72WA-3102)
(FAA-RD-73-59; Rept-4183-1) Avail: NTIS HC $12.25

The final results of a study of oceanic airspace and ground network configurations in satellite systems are presented. The purpose of the study was to investigate the restructuring of oceanic ATC airspace jurisdictional boundaries in the presence of a satellite system and to identify those future ATC jurisdictional configurations and ground facilities networks which most effectively utilize the satellite capability to obtain ground segment cost savings. The study was exploratory in nature and focused on the 1980 time frame. The analysis was limited to specified North Atlantic and Pacific oceanic regions. The report presents detailed descriptions of the study assumptions, the cost indicator model, and the evaluation techniques, as well as a number of ancilliary results regarding the technical and institutional environment of the oceanic aviation support system and the data base requirements encountered in performing the study. Author

**N73-33571#** Mitre Corp., McLean, Va.
**EXTRAPOLATED METHODOLOGY USED IN THE LOS ANGELES BASIN STANDARD TRAFFIC MODEL Final Report**
Frank Maginnis and Saul Cohen Washington FAA Apr. 1973 20 p refs
(Contract DOT-FA70WA-2448)
(AD-765153; MTR-6386; FAA-RD-73-86) Avail: NTIS CSCL 01/2

The Los Angeles Basin Standard Traffic Model is a computer model of the air traffic expected in the basin in 1982. The report explains the methodology used to project into the 1982 time frame a similar model of 1972 traffic. A technique known as time compression was used to make the projection. This report also defines the two types of models produced, the snapshot and scan-by-scan models, and it explains how the former was extracted from the later. (Modified author abstract) GRA

**N73-33572#** Naval Electronics Lab. Center, San Diego, Calif.
**OMEGA PHASE VARIATIONS DURING PCA (POLAR CAP ABSORPTION) EVENTS: SIGNALS TRAVERSING THE AURORAL REGION EXHIBIT EXTREME PHASE VARIATION PERSISTING UP TO A WEEK OR LONGER DURING PCA'S Research and Development Report, May 1969 - Sep. 1970**
J. N. Martin 17 Aug. 1972 34 p refs
(AD-764521; NELC-TR-1835) Avail: NTIS CSCL 17/7

From May 1969 to September 1970 the Omega navigation signals from Aldra, Norway, Forestport, New York, and Haiku, Hawaii were monitored at Wales, Alaska. The New York to Wales path and the Norway to Wales path traverse the auroral region and were both perturbed by 15 Polar Cap Absorption (PCA) events which occurred during the measurement period. The data over these paths were examined to determine the importance of the PCA-induced disturbances to the Omega system. It was found that the PCA's produce extreme phase deviations persisting for times up to a week or longer and were the dominating mechanism for phase variations in Omega propagation over these paths for approximately 5 percent of the time. The phase variations were found to be highly correlated with variations in solar proton flux in the 10 - 30 MeV energy range. Author GRA

**N73-32956*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**INTEGRATION OF STOL AIRPLANES INTO THE ATC SYSTEM**
Paul Peterson, Richard H. Sawyer, and Milton D. McLaughlin *In its* STOL Technol. 1972 p 291-306 Prepared in cooperation with FAA, Washington, D. C. (For availability see N73-32934 24-02)
CSCL 17G

**N73-32957*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**FOUR-D GUIDANCE OF STOL AIRCRAFT IN THE TERMINAL AREA**
Thomas Pecsvaradi and Heinz Erzberger *In its* STOL Technol. 1972 p 307-332 refs (For availability see N73-32934 24-02)
CSCL 17G

**N73-32958*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**TERMINAL-AREA STOL OPERATING SYSTEMS EXPERIMENTS PROGRAM**
Donald W. Smith, DeLamar Watson, and Jay V. Christensen *In its* STOL Technol. 1972 p 333-343 ref (For availability see N73-32934 24-02)
CSCL 01E

# 22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

**N73-33573** Cincinnati Univ., Ohio.
**A BIFOLD NUCLEAR POWER SOURCE Ph.D. Thesis**
Richard Arlen Wolfe 1972 196 p
Avail: Univ. Microfilms Order No. 73-18189

It was confirmed that the bifold nuclear power source (BIFOLD) using Pu-238 fuel is indeed feasible and within present day technology. The optimized system suggests the utilization of a hexagonal core configuration containing approximately 19.4 Kg of PuO2 fuel or 27.5 kg of PuO2 in a plutonia-molybdenum cermet (PMC) fuel and thermally cooled by about 19 individual gas controlled heat pipes containing potassium. The parametric design studies indicate that the power level ranges can be varied and depend upon the isotropic fraction of the Pu-238 in the fuel and the excess reactivity established for the core. For this design study the power range was chosen to be 10 to 15 Kwt in the isotopic power mode and up to 150 to 200 Kwt in the fast reactor mode. The lifetime may easily be 5 to 25 years depending upon the duty cycle, power level, and excess reactivity and is thought to be limited only by non-nuclear features. Dissert. Abstr.

**N73-33574#** Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
**RADIATION SAFETY AND PROTECTION IN INDUSTRIAL APPLICATIONS**
Herbert F. Klein, ed. Oct. 1972 309 p refs Symp. held at Washington, D. C., 16-18 Aug. 1972; sponsored jointly by Am. Soc. on Nondestructive Testing, AEC, Health Phys. Soc., and Natl. Inst. of Occupational Safety and Health
(DHEW-Publ-(FDA)73-8012; BRH/DEP-73-3) Avail: SOD HC $3.75

The proceedings of a conference on radiation safety and

protection in industrial applications are presented. The subjects discussed are: (1) principles of radiation protection, (2) uses of radiation safety monitoring equipment, (3) personnel monitoring, (4) radiation safety in airline maintenance, (5) inspection of parcels for contraband using ionizing radiation, (6) regulations governing radioisotopes, and (7) functions of governmental regulatory agencies. For individual titles, see N73-33575 through N73-33593.

**N73-33575** National Council on Radiation Protection and Measurements, Washington, D.C.
**PRINCIPLES OF RADIATION PROTECTION: AN EXERCISE IN JUDGEMENT**
Lauriston S. Taylor *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 8-26 refs (For availability see N73-33574 24-22)

The principles of protection of personnel from the effects of nuclear radiation are discussed. A chronology of events leading to improved industrial protection from radiation hazards is presented. Specific provisions of radiation protection laws are defined to show method of application and basic reasons for developing protective measures. Author

**N73-33576** National Bureau of Standards, Washington, D.C. Dosimetry Section.
**USES OF RADIATION SAFETY MONITORING EQUIPMENT**
T. P. Loftus *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 27-38 (For availability see N73-33574 24-22)

The characteristics and usage of various radiation safety monitoring devices for application to industrial safety protection are discussed. The instruments discussed are: (1) free-air chamber, (2) cavity chamber, (3) ion chamber, (4) GM tube, and (5) scintillation survey meters. The details of the construction of the instruments are provided. Tables and graphs are included to show the effectiveness of the sensors. Author

**N73-33577** Health Physics Associates, Highland Park, Ill.
**PERSONNEL MONITORING**
William B. Rivkin *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 39-94 refs (For availability see N73-33574 24-22)

The development, application, and characteristics of personnel protection devices for use in hazardous areas-where radioactive industry processes are discussed. A chronology of the acceptance and application of radiation measuring instruments is developed. The advantages and disadvantages of film dosimetry are analyzed. Special problems with measuring low exposures to radiation are identified. Graphs of the performance of various types of dosimeters are included. P.N.F.

**N73-33578** General Electric Co., Bridgeport, Conn.
**INDUSTRIAL RADIATION UTILIZATION: AN OVERVIEW, 1972**
Richard B. Socky *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 96-136 refs (For availability see N73-33574 24-22)

The application of radiation technology to nondestructive testing is discussed. The sources of radioactivity used for nondestructive tests are identified. The equipment used for conducting nondestructive tests is identified. Areas of specific application of radiation technology are reported. P.N.F.

**N73-33579** American Airlines, Inc., Tulsa, Okla. Maintenance and Engineering Center.
**RADIATION SAFETY IN AIRLINE MAINTENANCE**
Warren J. Weldon *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 137-147 (For availability see N73-33574 24-22)

The use of radiation technology and equipment for nondestructive tests of airframes are discussed. The specific application is to the servicing of commercial aircraft during ground maintenance periods. The hazards encountered and the precautions to be observed during radiological inspections are reported. Specific actions followed by the airlines to protect personnel from radiation hazards are explained. P.N.F.

**N73-33580** Barbroch and Wilcox Co., Barberton, Ohio. Nuclear Equipment Div.
**RADIATION SAFETY IN PRESSURE VESSEL INSPECTION**
H. D. Graber *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 149-164 (For availability see N73-33574 24-22)

The safety precautions to be observed when performing radiographic inspections of pressure vessels are reported. The facilities and equipment for conducting nondestructive tests of pressure vessels are described. The fundamentals of radiation safety are defined and specific applications for the protection of personnel are discussed. P.N.F.

**N73-33581** Conam Inspection, Inc., Tulsa, Okla.
**RADIATION SAFETY IN PIPELINE INSPECTION**
John G. Vancil *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 165-172 (For availability see N73-33574 24-22)

Radiation protection measures for personnel performing nondestructive tests and inspections of pipelines are discussed. The types of inspections which are performed are identified. The method of conducting a radiographic inspection is described. The various safety devices which are available for personnel protection are explained. P.N.F.

**N73-33582** Louisiana State Univ., Baton Rouge. Nuclear Science Center.
**RADIATION SAFETY WITH ISOTOPES**
Harry D. Richardson *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 173-179 (For availability see N73-33574 24-22)

The radiation hazards associated with handling radioactive isotopes are discussed. Precautionary methods to be followed by personnel required to handle radioactive materials are explained. Problems arising in communications, education, definition of terms, and indoctrinating personnel are presented. P.N.F.

**N73-33583** Ohmart Corp., Cincinnati, Ohio.
**RADIATION SAFETY FOR GAGE INSTALLATIONS**
H. L. Cook, Jr. *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 181-191 refs (For availability see N73-33574 24-22)

The use of gages in industry for detecting, measuring, or controlling thickness, density, level, or interference location is discussed. The radiation hazards associated with such gages are defined. Precautions to be observed by industrial personnel to avoid exposure to the radioactive materials contained in the gages are defined. P.N.F.

**N73-33584** Westinghouse Research Labs., Pittsburgh, Pa. Astronuclear Lab.
**SAFE RADIATION PRACTICES IN TIRE INSPECTION**
Maury Beebe *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 193-205 (For availability see N73-33574 24-22)

The radiation hazards associated with radiographic inspection of tires are described. Protective measures to avoid exposure of personnel to radiation hazards during the inspection procedure are discussed. The procedures for conducting safety surveys and the use of individual radiation detection devices are explained. P.N.F.

**N73-33585** Air Force Postal and Courier Service, Springfield, Va.
**THE INSPECTION OF PARCELS FOR CONTRABAND USING IONIZING RADIATION**
John H. Bowman *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Dec. 1972 p 207-216 (For availability see N73-33574 24-22)

The requirements for developing a device to conduct inspections of parcels for contraband items using ionizing radiation are discussed. A machine to perform the desired operation was built and its construction and method of operating are explained. The precautions to be observed in operating the inspection device are identified. Specific application to the inspection of parcels traveling through military postal facilities is described. P.N.F.

**N73-33586** Minnesota Univ., Minneapolis. School of Public Health.
**RADIATION SAFETY IN BOMB DETECTION UTILIZING RADIATION TECHNIQUES**
Jerome W. Staiger and Ralph O. Wollan *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 217-232 refs (For availability see N73-33574 24-22)

The use of X-ray fluoroscopy and radiography for determining the presence of bombs in suspicious packages is discussed. Procedures for protecting personnel,who conduct such inspections from the effects of radiation are described. The procedures to be followed to avoid exposure to radiation are explained. A table is included to show the radiation exposure rate which is produced by a typical fluoroscopic X-ray generator. P.N.F.

**N73-33587** Department of Labor, Washington, D.C.
**THE IMPLEMENTATION OF THE OCCUPATION HEALTH AND SAFETY ACT OF 1970**
John P. ONeill *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 233-237 (For availability see N73-33574 24-22)

The Occupation Health and Safety Act of 1970 is discussed. The law states that each employer shall furnish each employee a place of employment which is free from recognized hazards. The employee shall comply with occupational safety and health standards and rules and regulations applicable to his own actions and conduct. Problem areas which were created by implementation of the act are reported. The requirement to measure and monitor dangerous environments for compliance with the act is explained. P.N.F.

**N73-33588** National Bureau of Standards, Washington, D.C. Center for Radiation Research.
**SAFETY RECOMMENDATIONS IN ANSI DOCUMENTS**
Elmer H. Eisenhower *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 240-253 refs (For availability see N73-33574 24-22)

The safety recommendations contained in documents issued by the American National Standards Institute are discussed. The important types of standards are identified. The manner in which the standards are prepared and implemented are analyzed. The organization of a specific committee to establish standards for radiation protection is explained. P.N.F.

**N73-33589** Atomic Energy Commission, Washington, D.C. Materials Branch.
**REGULATIONS GOVERNING RADIOISOTOPES**
James C. Malaro *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 255-268 (For availability see N73-33574 24-22)

Atomic Energy Commission policies and procedures for licensing and regulating the industrial uses of radioisotopes are discussed. A brief review of the following areas is presented: (1) the source and limitations of the Commission's regulatory authority and the provisions for delegating some of this authority to the States, (2) the regulations which are directly applicable to the industrial use of radioisotopes, (3) the different types of authorizations under which radioisotopes may be possessed and used and the users' obligations under each type of authorization, (4) the Commission's program for evaluating sealed sources and devices and (5) the Commission's procedures for keeping the public informed. The processing of license applications and how the applicant can insure expeditious handling of his application are explained. Author

**N73-33590** Bureau of Radiological Health, Rockville, Md.
**INDUSTRIAL RADIATION PROTECTION UNDER THE RADIATION CONTROL FOR HEALTH AND SAFETY ACT**
Walter E. Gundaker and Robert L. Elder *In its* Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 269-281 (For availability see N73-33574 24-22)

The current activities of the Bureau of Radiological Health, Food and Drug Administration, to carry out the requirements of the Radiation Control for Health and Safety Act as it applies to industrial radiation equipment are presented. The provisions of the Act and the Regulations published subsequent to it are discussed, with emphasis on the radiation safety performance standards that will directly affect industrial radiation protection. Author

**N73-33591** Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Radiological Health.
**THE STATE'S ROLE IN INDUSTRIAL RADIATION SAFETY**
Thomas M. Gerusky *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 283-291 (For availability see N73-33574 24-22)

The function of state governments in enforcing radiation safety and protection methods is duscussed. Regulations covering industrial, research, and medical uses of ionizing radiation are described. Specific examples of state enforcement of safety requirements are presented. Author

**N73-33592** National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Div. of Technical Services.
**THE ROLE OF THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH IN INDUSTRIAL RADIATION SAFETY**
Gerald J. Karches *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 293-298 (For availability see N73-33574 24-22)

The function of the National Institute for Occupational Safety and Health in industrial radiation safety is discussed. The areas of industrial radiation safety are identified. Responsibilities for ionizing radiation relate to only those ionizing sources in the workplace not covered by Atomic Energy Commission regulations. There is a broader responsibility for non-ionizing radiation in the radio frequency region which include ultrasonic, short wave, and microwave radiation. Specific examples of regulation enforcement are reported. P.N.F.

**N73-33593** Ohio State Univ., Columbus.
**TRENDS IN RADIATION PROTECTION: THE LITTLE THINGS THAT COUNT IN RADIATION SAFETY**
Robert C. McMaster *In* Bur. of Radiol. Health Radiation Safety and Protect. in Ind. Appl. Oct. 1972 p 299-307 (For availability see N73-33574 24-22)

The recommended practices for avoiding exposure of personnel to radiation hazards are discussed. Specific steps to follow in establishing safe conditions are analyzed. Radiation shielding methods are identified and future trends in radiation control and protection are presented. P.N.F.

**N73-33594*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**MEASURED AND CALCULATED FAST NEUTRON SPECTRA IN A DEPLETED URANIUM AND LITHIUM HYDRIDE SHIELDED REACTOR**
Gerald P. Lahti and Robert A. Mueller Washington Oct. 1973 15 p refs
(NASA-TM-X-2906; E-7485) Avail: NTIS HC $2.75 CSCL 18J

Measurements of MeV neutron were made at the surface of a lithium hydride and depleted uranium shielded reactor. Four shield configurations were considered: these were assembled progressively with cylindrical shells of 5-centimeter-thick depleted uranium, 13-centimeter-thick lithium hydride, 5-centimeter-thick depleted uranium, 13-centimeter-thick lithium hydride, 5-centimeter-thick depleted uranium, and 3-centimeter-thick depleted uranium. Measurements were made with a NE-218 scintillation spectrometer; proton pulse height distributions were differentiated to obtain neutron spectra. Calculations were made using the two-dimensional discrete ordinates code DOT and ENDF/B (version 3) cross sections. Good agreement between measured and calculated spectral shape was observed. Absolute measured and calculated fluxes were within 50 percent of one another; observed discrepancies in absolute flux may be due to cross section errors. Author

**N73-33595*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**FABRICATION OF CERMET BEARINGS FOR THE CONTROL SYSTEM OF A HIGH TEMPERATURE LITHIUM COOLED NUCLEAR REACTOR**
Howard G. Yacobucci, Richard L. Heestand (Battelle Columbus, Labs.), and Donald E. Kizer (Battelle Columbus Labs.) Washington

Oct. 1973 31 p refs
(NASA-TM-X-2892; E-7500) Avail: NTIS HC $3.00 CSCL 18L

The techniques used to fabricate cermet bearings for the fueled control drums of a liquid metal cooled reference-design reactor concept are presented. The bearings were designed for operation in lithium for as long as 5 years at temperatures to 1205 C. Two sets of bearings were fabricated from a hafnium carbide - 8-wt. % molybdenum - 2-wt. % niobium carbide cermet, and two sets were fabricated from a hafnium nitride - 10-wt. % tungsten cermet. Procedures were developed for synthesizing the material in high purity inert-atmosphere glove boxes to minimize oxygen content in order to enhance corrosion resistance. Techniques were developed for pressing cylindrical billets to conserve materials and to reduce machining requirements. Finishing was accomplished by a combination of diamond grinding, electrodischarge machining, and diamond lapping. Samples were characterized in respect to composition, impurity level, lattice parameter, microstructure and density. Author

**N73-33596#** Atomics International, Canoga Park, Calif.
**GEOM: A THERMAL-HYDRAULIC STRESS CODE**
E. Moody 10 May 1973 85 p refs
(Contract AT(04-3)-701)
(AI-AEC-13065) Avail: NTIS HC $5.45

The GEOM computer code (IBM/360) is described as it existed at the SNAP program close out. The code performs thermal, hydraulic and stress analysis on a liquid metal ZrH reactor core. The theory and empirical data used are described in detail. Instructions for using the code are given with a sample problem for illustration. Author (NSA)

**N73-33597#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**FUELS AND MATERIALS DEVELOPMENT PROGRAM Quarterly Progress Report, period ending 31 Dec. 1972**
P. Patriarca May 1973 240 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4105) Avail: NTIS

All of the creep tests designated for 50,000 hr in the type 304 stainless steel data list are underway. Creep characterization of the reference heat by-product form is progress. Creep tests on the heat-to-heat variation study of type 304 stainless steel are proceeding; results of tests at 593 C indicate a 1.6% total strain variation in the behavior of seven heats for times of about 11,000 hr at a stress of 17,000 psi. In exploratory tests to evaluate creep hardening rules, the results from low stress tests were not conclusive, but at high stress the strain hardening rule seems to be realistic. Cracks were observed in type 304 stainless steel at strain ranges in excess of 1%, especially at strain rates of 0.005/min and lower. Author (NSA)

**N73-33598#** Oak Ridge Y-12 Plant, Tenn.
**PRECURSOR CARBON AND MOLDED GRAPHITE STUDIES NERVA Fuel Element Development Program Summary Report, Jul. 1966 - Jun. 1972**
L. G. Overholser, comp. 6 Apr. 1973 92 p refs
(Contract W-7405-eng-26)
(Y-1857) Avail: NTIS HC $3.00

Isotruxene, cinnamylideneinden, acenaphthalene, and mixtures of some of these carbon precursors were carbonized by heating in a nitrogen atmosphere at ambient pressure to temperatures of 550 C, or by pressure cooking in a gas autoclave at 700 C and 15,000 psi of argon. Samples of these carbons fired to 2,800 C and commercial carbons obtained from various graphite manufacturers were characterized by X-ray diffraction and metallographic methods. Many of the carbons were used as fillers in the fabrication of graphites using hotpressing techniques. Author (NSA)

**N73-33599#** Gulf General Atomic, San Diego, Calif.
**DEVELOPMENT OF A THERMIONIC REACTOR SPACE POWER SYSTEM Summary Report, 1 Mar. - 30 Jun. 1972**
5 Jan. 1973 302 p refs
(Contract AT(04-3)-840)
(Gulf-GA-A-12251) Avail: NTIS HC $3.00

The fabrication and performance of UC and UO2 thermionic fuel elements are described. Physics calculations and design parameters for the reference design electric propulsion reactor are presented. NSA

**N73-33600*#** Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
**STUDY OF THE COLLECTOR/HEAT PIPE COOLED EXTERNALLY CONFIGURED THERMIONIC DIODE Final Report**
6 Mar. 1973 83 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953074)
(NASA-CR-135785; WANL-PR-953074-14) Avail: NTIS HC $6.25

A collector/heat pipe cooled, externally configured (heated) thermionic diode module was designed for use in a laboratory test to demonstrate the applicability of this concept as the fuel element/converter module of an in-core thermionic electric power source. During the course of the program, this module evolved from a simple experimental mock-up into an advanced unit which was more reactor prototypical. Detailed analysis of all diode components led to their engineering design, fabrication, and assembly, with the exception of the collector/heat pipe. While several designs of high power annular wicked heat pipes were fabricated and tested, each exhibited unexpected performance difficulties. It was concluded that the basic cause of these problems was the formation of crud which interfered with the liquid flow in the annular passage of the evaporator region. Author (NSA)

**N73-33601#** Oak Ridge National Lab., Tenn.
**FUELS AND MATERIALS DEVELOPMENT PROGRAM Quarterly Progress Report, period ending 30 Sep. 1972**
P. Patriarca Jan. 1973 217 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4055) Avail: NTIS

The behavior of weldments in austenitic stainless steel at 370 to 750 C as a function of both welding process and the variables within a process is being evaluated for application to LMFBR vessels and components. The investigation covers both heavy-section weldments, which are applicable to reactor vessels as well as other components, and thinner section weldments, which are applicable to piping. Major sections of both the heavy-section and piping weldment studies are concerned with the development and evaluation (including the determination of elevated-temperature design data) of improved filler metals that contain controlled additions of minor elements for increased strength and ductility. A limited effortis continuing to gain fundamental information on the welding of materials such as incoloy 800, austenitic stainless steels, and ferritic steels that are used in critical nuclear components. The major concern with the first two materials is their propensity to microfissure, while both hot- and cold-cracking have been problems with the ferritic steels.

Author (NASA)

**N73-33602#** Gulf General Atomic, San Diego, Calif.
**THERMIONIC REACTOR POWER SYSTEM DEVELOPMENT. VOLUME 4: REACTOR PLAN**
13 Mar. 1973 57 p refs
(Contract AT(04-3)-840)
(Gulf-GA-C-12308-Vol-4) Avail: NTIS HC $5.00

The thermionic reactor is based on application of a thermionic reactor power system to nuclear electric propulsion (NEP) missions. The plan includes all development activities: design, analysis, experimental engineering, fabrication development, manufacturing, and testing for each reactor in the development program. Scheduling of reactor development activities is based on an overall program plan leading to production of a flight reactor for 1983 launch. The reactor includes: fuel elements, vessel, internals, reflectors, control drives, bus bars, reactor auxiliaries, and the control and instrumentation subsystem. The reactor auxiliaries include cesium supply and fission product management subsystems. The control and instrumentation subsystem includes subsystems for: nuclear instrumentation, cesium pressure control, drum drive power, malfunction detection, and electrical output and miscellaneous monitoring instrumentation. Author (NSA)

**N73-33603#** Atomics International, Canoga Park, Calif.
**SELECTED COMPUTER CODES AND LIBRARIES. VOLUME 1: ZIP, A TIMESHARE PROGRAM FOR SNAP REACTOR PARAMETRIC STUDIES**
H. Rood 21 Jun. 1973 62 p refs

(Contract AT(04-3)-701)
(AI-AEC-13076-Vol-1) Avail: NTIS HC $5.25

ZIP is a FORTRAN program written for the Honeywell 440 timeshare computer. It is a parametric survey code which applies specifically to SNAP-type nuclear reactor; i.e., compact U-ZrH-fueled, beryllium-reflected, NaK-cooled reactors. As input, the code requires information about the mission requirements (power level, operating lifetime, coolant outlet temperature, etc.) and sufficient dimensional information to describe the reactor (fuel length, cladding thickness, reflector thickness, etc.). Then, using simple equations fit to results obtained using more complex codes, ZIP determines all the significant nuclear and thermal performance characteristics of the reactor. Also included is a shield thickness calculation, and a calculation of the reactor and shield weights. Author (NSA)

**N73-33604#** Atomics International, Canoga Park, Calif.
**SELECTED COMPUTER CODES AND LIBRARIES. VOLUME 5: TEMPRO, A HEAT TRANSFER-LIFETIME CODE FOR SNAP REACTOR ANALYSIS**
L. D. Felten and E. Moody 24 May 1973 61 p refs
(Contract AT(04-3)-701)
(AI-AEC-13076-Vol-5) Avail: NTIS HC $5.25

The TEMPRO computer program does heat transfer and reactivity calculations as a function of time for SNAP-type reactors. It determines hydrogen loss rates and the associated reactivity loss. Fuel swelling, uranium burnup, and fission product buildup are considered. Author (NSA)

**N73-33605#** Atomics International, Canoga Park, Calif.
**SELECTED COMPUTER CODES AND LIBRARIES. VOLUME 4: A 28-GROUP CROSS SECTION LIBRARY FOR SNAP REACTOR ANALYSIS**
J. M. Otter 31 May 1973 133 p refs
(Contract AT(04-3)-701)
(AI-AEC-13076-Vol-4) Avail: NTIS HC $8.75

A library of 28-group neutron cross sections designed for SNAP reactor analyses is described. Sources of microscopic cross section data, flux weighting spectra, and data processing methods are given. A listing of the library in the ANISN code format is included. Author (NSA)

**N73-33606#** Atomics International, Canoga Park, Calif.
**BURNABLE POISON DEPOSITION ON ZIRCONIUM HYDRIDE FUEL: PROCESS DEVELOPMENT AND EVALUATION**
R. VanHouten 22 Jun. 1973 62 p refs
(Contract AT(04-3)-701)
(AI-AEC-13085) Avail: NTIS HC $5.25

The development and evaluation of a process for depositing thin rare earth oxide burnable poison films on fuel rods are reviewed. The burnable poison films are formed by controlled-rate, electron-beam-heated, high-vacuum evaporation of the oxides from water-cooled crucibles. Coating uniformity (mg poison/sq cm) and reproducibility are good (to + or - 5%), and rapid, accurate nondestructive X-ray fluorescence analytical procedures permit up to 100% inspection (all surface areas of all coated fuel rods). Poison placement screening criteria, recommended coating and measuring equipment performance, and swelling and aging test results are given. All test results for Gd2O3, Er2O3, and Y2O3 coatings are promising. Vapor-deposited coatings containing Eu2O3 and/or Sm2O3 are not recommended, because of rapid transfer of Eu and Sm to the SCB hydrogen barrier; but preliminary tests on the incorporation of up to 9 wt % Eu in an SCB-type sleeve showed good Eu retention through 1510 hr at 1430 F, and good SCB stability. Tests extended to 18,584 hr at 1300 F, to 10,000 hr at 1400 F, and to 5000 hr at 1500 F. Author (NSA)

**N73-33607#** Atomics International, Canoga Park, Calif.
**ZIRCONIUM HYDRIDE REACTOR CORE HEAT TRANSFER STUDIES SUMMARY REPORT**
A. R. Marchese and A. N. Gallegos 15 Jun. 1973 64 p refs
(Contract AT(04-3)-701)
(AI-AEC-13088) Avail: NTIS HC $5.35

The results are presented of a study showing the influence of rod spacers on the heat transfer to a liquid metal (NaK-78) in turbulent longitudinal flow through a closely spaced rod bundle. The rod bundle consists of 19 electrically heated elements, which are arranged on hexagonal arrays having a pitch-to-diameter (P/D) ratio of 1:50. Two rod configurations, each with a different type of rod spacer, were investigated. The first configuration utilized ring spacers which were banded to the outer surfaces of each test rod. For the second configuration, helical-fin spacers were attached to the cladding tubes. Heat transfer results for the cladding circumferential temperature distribution and the rod-average film coefficients were obtained over a range of heating and flow conditions of interest to compact reactor cores. For the rod-average film coefficient, the helical fin configuration showed a significant improvement over the predicted smooth tube results. Author (NSA)

**N73-33608#** Mound Lab., Miamisburg, Ohio.
**CONVENTIONAL DRAWING OF Pt PLUS 20 WT PERCENT Rh HEAT SOURCE (ACE) LINER BODIES**
D. A. Pawlak and W. C. Wyder 15 Jun. 1973 16 p
(Contract AT(31-1)-GEN-53)
(MLM-1972) Avail: NTIS HC $4.00

Fabrication is described of Pt + 20 wt. % Rh liner bodies for a U.S. Army Corps of Engineers radioisotopic heat source similar in design to the Milliwatt Generator (MWG) heat source. Strain hardening, component design, and poor draw quality material required a two stage drawing operation with an intermediate anneal. First and second draw tooling were designed, fabricated, and successfully applied in the forming of liner bodies to desired specifications. Author (NSA)

**N73-33609#** Atomics International, Canoga Park, Calif.
**RADIATION SHIELDING FOR ZIRCONIUM HYDRIDE REACTOR SYSTEMS**
V. Keshishian, J. V. Facha, R. J. Thomson, and F. H. Welch
26 Jun. 1973 192 p refs
(Contract AT(04-3)-701)
(AI-AEC-13081) Avail: NTIS HC $11.75

A summary is given of the radiation shielding for zirconium hydride (ZrH) reactors. Shield nuclear calculational methods are discussed. The shield variations for unmanned and manned space systems, in addition to terrestrial systems, are presented. Both neutron and gamma-ray shield fabrication methods for ZrH reactor shields are discussed in detail. The nuclear and mechanical aspects of the 5-kWe Reactor Thermoelectric System shield are presented in detail. Author (NSA)

**N73-33610#** Los Alamos Scientific Lab., N.Mex.
**MATERIALS COMPATIBILITY PROBLEM IN SNAP FUEL CAPSULES**
R. N. R. Mulford and S. E. Bronisz [1973] 11 p refs Presented at the Symp. on Mater. Performance in Operating Nucl. Systems, Ames, Iowa, 28 Aug. 1973
(LA-UR-73-764; Conf-730801-2) Avail: NTIS HC $3.00

The tantalum based alloys used for fuel capsules in some types of radioisotopic thermoelectric generators (RTG's) were chosen originally because of their superior strength properties at elevated temperatures. However, basic incompatibility between the (Pu-238)O2 fuel and the tantalum alloys was predicted from thermodynamic considerations. Oxygen transfer from fuel to container leads to severe embrittlement and consequent impairment of the container. The incompatibility was demonstrated both in laboratory experiments and in prototype RTG's. The scheme used to solve this problem and determine conditions under which Ta alloys are stable in the desired application are described and discussed. Author (NSA)

# 23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

**N73-33611** Illinois Univ., Urbana.
**SURFACE ROUGHNESS EFFECTS ON BIDIRECTIONAL REFLECTANCE Ph.D. Thesis**
Theodore Franklin Smith 1972 123 p

Avail: Univ. Microfilms Order No. 73-17428

An experimental study of surface roughness effects on bidirectional reflectance of metallic surfaces is presented. A facility capable of irradiating a sample from normal to grazing incidence and recording plane of incidence bidirectional reflectance measurements was developed. Samples consisting of glass, aluminum alloy, and stainless steel materials were selected for examination. Samples were roughened using standard grinding techniques and coated with a radiatively opaque layer of pure aluminum. Mechanical surface roughness parameters, rms heights and rms heights and rms slopes, evaluated from digitized surface profile measurements are less than 1.0 and 0.28, respectively. Rough surface specular, bidirectional, and directional reflectance measurements for selected values of polar angle of incidence and wavelength of incident energy within the spectral range of 1 to 14 are reported. Dissert. Abstr.

**N73-33612** University of Southern Calif., Los Angeles.
**SUBSONIC JET NOISE MEASUREMENTS BY MEANS OF A DIRECTIONAL MICROPHONE SYSTEM Ph.D. Thesis**
Kai Kao 1973 127 p
Avail: Univ. Microfilms Order No. 73-18821

An investigation was conducted concerning the noise source distribution of the cold, high-subsonic jets of 1 in and 2 in diameters, by means of a reflector-type directional microphone system which operates on the imaging principle of a spherical concave reflector. The results thus obtained were then compared with the ordinary single microphone measurements at 90 deg from the jet-axis. A close agreement obtained in the total acoustic power and the frequency spectrum between the two systems, suggested the present technique was quantitatively justified. The actual noise source distribution of the jet was obtained in narrow frequency bands. It was found that the Strouhal number fD/V sub j and the distance parameter x/d were two important factors in estimating the narrow-band sound power emitted from the slice (0 to x) with a peak at fD/V sub j = 0.25, as measured at 90 deg from the jet-axis. It was also observed that 40% of the total acoustic power was generated in the mixing region (x/d = 0 to 5), 80 - 90% in the first 10 diameters, and all was completed at x/d = 20. Dissert. Abstr.

**N73-33613** Illinois Univ., Urbana.
**COLFTAR: A REAL-TIME ELECTRO-OPTICAL SYSTEM FOR TWO-DIMENSIONAL FOURIER TRANSFORMS Ph.D. Thesis**
Douglas Stuart Sand 1972 125 p
Avail: Univ. Microfilms Order No. 73-17399

An electro-optical system is described which generates optical Fourier transforms of two-dimensional video images in real time, and at standard video frame rates. This system is designated COLFTAR, which denotes cooled on-line Fourier transform and reconstruction. The theory, construction, and operation of the system and its principal components are described in detail, with special emphasis on the resolution and modulation characteristics of the cooled-crystal electro-optic light valve (or Ardenne tube) which is the central component of the system. Several application examples are included, as well as a summary of possible improvements. The essential components of the system are: pulsed laser source, electro-optical light valve, optics including Fourier transform lens, reference beam, vidicon detector, and support electronics. Dissert. Abstr.

**N73-33614** Colorado Univ., Boulder.
**EXPERIMENTAL INVESTIGATION OF SOUND PROPAGATION IN BINARY MIXTURES OF NOBLE GASES Ph.D. Thesis**
Manuel FuentesLosa 1972 212 p
Avail: Univ. Microfilms Order No. 73-18562

The frequency dependence of the velocity of propagation of ultrasonic waves in helium-argon and helium-xenon mixtures was measured, as the absorption coefficient in helium-xenon mixtures, all for the first time. The results are in excellent agreement with the predictions of a theory based on the linearized Boltzmann Equation. Dissert. Abstr.

**N73-33615** Virginia Univ., Charlottesville.
**MONTE CARLO INVESTIGATION OF TRANSIENT ACOUSTIC FIELDS IN PARTIALLY OR COMPLETELY BOUNDED MEDIUM Ph.D. Thesis**
Balakrishna Dattatraya Thanedar 1973 371 p
Avail: Univ. Microfilms Order No. 73-18997

A Monte Carlo technique for the determination of the transient radiation fields in partially or completely bounded media is presented. The impetus for the selection of this topic is that the analysis of the radiation in a partially or completely bounded medium presents a problem of common interest in many branches of engineering and physics. A more general basic technique is developed with special emphasis on applications to acoustical field solutions. It investigates what happens to the field in terms of signal paths of disturbance originating from the energy source, and reconstructs the field as a function of space and time on a statistical basis. For this analysis, a suitable model is created from which is developed an algorithm for the estimation of the acoustic pressure variations, as a function of space and time. Dissert. Abstr.

**N73-33616** Florida State Univ., Tallahassee.
**TRANSIENTS IN THE SCATTERING BY HYDROMETEORS Ph.D. Thesis**
Peter Sawin Ray 1973 158 p
Avail: Univ. Microfilms Order No. 73-18296

Approximations to the far field, back scattering response for an electromagnetic impulse are shown for two water and three ice sphere sizes. The dielectric properties used were obtained from a refractive index model applicable from 20C to 0C for ice and from -20C to 50C for water. The model is applicable over the spectral interval 2 micrometer to several thousand kilometers wavelength for ice and from 2 micrometer to several hundred meters wavelength for water. It is shown that transient effects are confined effectively to a space equivalent time of less than six diameters for both ice and water and thus can be neglected in all operational applications of pulse radar to hydrometeor detection. Dissert. Abstr.

**N73-33617#** Nauka Press, Moscow (USSR).
**THEORY OF ELECTROACOUSTICAL CONVERTERS: WAVE PROCESSES, VOLUME 1 [TEORIYA ELEKTROAKUSTICHESKIKH PREOBRAZOVATELEY. VOLNOVYYE PROTSESSY, IZBRANNYYE TRUDY V TREKH TOMAKH, TOM 1]**
A. A. Kharkhevich 1973 400 p refs In RUSSIAN
Avail: NTIS HC $22.00

The theory of electroacoustical images is developed, and a relationship is established between the geometric form of horn and sound antennas and their acoustical characteristics. Wave diffraction is considered from a straight-line edge and from a circular opening and methods are proposed for solving diffraction problems. Non-steady state wave phenomena are investigated, including the case of diffraction, and an evaluation is given for energy relations in a nonstationary wave field. Transl. by K.P.D.

**N73-33618*#** New Mexico Univ., Albuquerque. Technology Application Center.
**NOISE POLLUTION RESOURCES COMPENDIUM Quarterly Update, 1 Jan. - 31 Mar. 1973**
31 Mar. 1973 129 p refs Sponsored by NASA
(NASA-CR-135954; TAC-BIBL-2(73/1)) Avail: NTIS HC $8.50 CSCL 20A

Abstracts of reports concerning noise pollution are presented. The abstracts are grouped in the following areas of activity: (1) sources of noise, (2) noise detection and measurement, (3) noise abatement and control, (4) physical effects of noise and (5) social effects of noise. F.O.S.

**N73-33619#** Advisory Group for Aerospace Research and Development, Paris (France).
**OPTICS OF THE SEA (INTERFACE AND IN-WATER TRANSMISSION AND IMAGING)**
Aug. 1973 431 p In ENGLISH; partly in FRENCH
(AGARD-LS-61) Avail: NTIS HC $23.75

The proceedings of a conference on the optical properties of the sea are reported. The subjects discussed include the following: (1) reflection and refraction of light at the sea surface, (2) refractive index fluctuations in sea water, (3) the theory of small angle scattering, (4) underwater visibility and imaging, (5) sources of light for underwater illumination, (6) long range vision

techniques, and (7) spatial filtering and image restoration. For individual titles, see N73-33620 through N73-33638.

**N73-33620** Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France). Div. des Previsions Ionospheriques.
**INTRODUCTION TO THE ELECTROMAGNETISM OF THE SEA [INTRODUCTION A L'ELECTROMAGNETISME DES MERS]** c13
P. Halley *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 38 p refs In FRENCH (For availability see N73-33619 24-23)

The Debye theory of polarization of liquids was used to calculate real permittivity and conductivity of the sea. Also, visible light temperature measurements were used to observe superficial temperature and chemical composition of the sea surface. The effects of surface emissitivity, reflection, and refraction are discussed. Transl. by E.H.W.

**N73-33621** Institute of Physical Oceanography, Copenhagen (Denmark).
**RADIANCE DISTRIBUTION BELOW THE SEA SURFACE** c13
Kjell Nygard *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 22 p refs (For availability see N73-33619 24-23)

Radiance distribution as a function of depth are the most basic radiometric quantities for describing the structure of the solar and global field of radiation in the upper layers of the sea. Immediately below the sea surface the radiance distribution is chiefly determined by the radiance distribution aoove the surface and by the reflecting and refracting properties of the air - water interface. Through the processes of absorption and scattering by the water itself and by dissolved and suspended matter the initial radiance distribution is progressively changed with increasing depth. A survey is given of concepts of inherent and apparent optical properties, and simple models describing their interrelations and relations to the radiance distribution through the classical, time-independent equation of radiative transfer are presented. Some experimental data are presented and discussed. A brief account of the polarization of the underwater light field is given. Author

**N73-33622** Centre de Recherches Oceanographiques, Villefranche-sur-Mer (France). Lab. d'Oceanographie Physique.
**BRIEF ON THE THEORIES OF RADIATIVE TRANSFER-APPLICATION TO PROPAGATION IN THE SEA [APERCU SUR LES THEORIES DU TRANSFERT RADIATIF APPLICABLES A LA PROPAGATION DANS LA MER]**
L. Prieur and A. Morel *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 25 p refs In FRENCH (For availability see N73-33619 24-23)

Several theories on the propagation of electromagnetic waves in sea water are briefly discussed. Data cover transfer equations, computer methods, spherical harmonics, asymptotic methods, and perturbation theory. Transl. by E.H.W.

**N73-33623** Paris Univ. (France). Lab. d'Oceanographie Physique.
**SOLAR ENERGY AND SEASONAL THERMOCLINE [ENERGIE SOLAIRE ET THERMOCLINE SAISONNIERE]**
J. P. Bethoux and A. Ivanoff *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 7 p refs In FRENCH (For availability see N73-33619 24-23)

Various factors affecting the seasonal thermocline of the sea are studied by marine photometry. Specifically, the effects of advection, vertical temperature profiles, energy absorption, mixing boundary layer, and marine currents are discussed. Transl. by E.H.W.

**N73-33624** Paris Univ. (France). Lab. d'Oceanographie Physique.
**PHYSICAL FACTORS, CHEMICAL AND BIOLOGICAL EFFECT OF THE PROPAGATION OF LIGHT IN SEA WATER**
Alexandre Ivanoff *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 45 p refs In FRENCH (For availability see N73-33619 24-23)

Definitions are given of parameters pertinent to characterizing the optical properties of turbulent and pure sea water. Various other factors affecting the optical properties of sea water including materials suspended in the water, substances in solution, and incidence of refraction are discussed. Data are also given on the spatial and temporal distribution of optical properties. Transl. by E.H.W.

**N73-33625** Tetra Tech, Inc., Pasadena, Calif.
**REFRACTIVE INDEX FLUCTUATIONS IN SEA WATER**
Henri Hodara *In* AGARD Cptics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 14 p refs (For availability see N73-33619 24-23)

Mathematical methods for predicting the effects of thermal and saline inhomogeneities on optical imaging systems are presented. Temperature and salinity variations cause corresponding fluctuations in the refractive index resulting in loss of resolution. Formulas are developed for the refractive index changes in terms of their gradient with respect to salinity and temperature. It is stated that a dual-scan system is fairly immune to temperature and slinity fluctuations. Author

**N73-33626** Oregon State Univ., Corvallis. School of Oceanography.
**VARIATION OF OPTICAL SEA PARAMETERS WITH DEPTH**
J. Ronald V. Zanevald *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 22 p refs (For availability see N73-33619 24-23)

The depth dependence of light scattering and attenuation parameters in the ocean are discussed. The theoretical dependence of optical parameters on the concentration, size distribution and physical parameters of the particulate matter is discussed. A simple model for the depth dependence of particulate matter concentrations is presented. Results agree qualitatively with observed distributions. The interrelation of optical parameters, particle concentration and hydrographic parameters as obtained from experimental observations in several areas is discussed. Author

**N73-33627** Centre de Recherches Oceanographiques, Villefranche-sur-Mer (France).
**DIFFUSION OF LIGHT BY SEA WATER. EXPERIMENTAL RESULTS AND THEORETICAL APPROACH [DIFFUSION DE LA LUMIERE PAR LES EAUX DE MER. RESULTATS EXPERIMENTAUX ET APPROCHE THEORIQUE]**
Andre Morel *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 76 p refs In FRENCH (For availability see N73-33619 24-23)

Several theories - Rayleigh, Rayleigh-Gans, and Mie used to calculate light propagation in sea water as a function of absorption and diffusion are discussed. The effects of polarization, polydispersed and spherical particles, and long wave radiation are also discussed. Definitions of various parameters used and experimental results are given in an appendix. Transl. by E.H.W.

**N73-33628** Tetra Tech, Inc., Pasadena, Calif.
**THEORY OF SMALL ANGLE SCATTERING**
Willard H. Wells *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 19 p refs (For availability see N73-33619 24-23)

The fundamental description of light scattering by particles in sea water is presented. The volume scattering function is defined as the amount of light scattered per meter into a differential solid angle in a given direction. For multiple scattering a derived quantity called the point spread function is needed to describe the intensity blur distribution at a given range. Numerical relationships are developed to show the effects of various parameters on visibility conditions. Author

**N73-33629** Tetra Tech, Inc., Pasadena, Calif.
**EXPERIMENTAL RESULTS OF SMALL ANGLE SCATTERING**
Henri Hodara *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 17 p refs (For availability see N73-33619 24-23)

The characteristics of light scattering at large angles, small angles, and very small angles. For each of the angular ranges,

the relative contributions from refraction and diffraction are calculated. It was determined that large angle scattering is mostly due to diffraction, while refraction is responsible at small angles. The results of scattering measurements by point spread function and by modulation transfer function are presented. Author

**N73-33630** Tetra Tech, Inc., Pasadena, Calif.
**FACTORS AFFECTING LONG RANGE VISION** **c04**
Willard H. Wells *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 10 p refs (For availability see N73-33619 24-23)

The various phenomena which affect long range underwater vision are discussed. The most important factors are: (1) decay of light in narrow and broad beams, (2) light backscattered from particulate matter, (3) return light whose image information is scrambled by small angle scatter enroute to the detector, (4) the statistics of detected photons, and (5) signal to noise ratio criteria for imaging. Mathematical models are presented to show the effects of the various factors. Author

**N73-33631** Tetra Tech, Inc., Pasadena, Calif.
**CRITERIA FOR VISION: RESOLUTION, SIGNAL-TO-NOISE RATIO CONTRAST** **c04**
Henri Hodara *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 13 p refs (For availability see N73-33619 24-23)

The vision criteria of resolution, signal to noise ratio, and contrast are discussed. The concepts are applied to calculate the ultimate resolution of underwater imaging systems. It is stated that a signal to noise ratio of five is sufficient to ensure image quality. Mathematical models of the factors affecting underwater vision are developed. Author

**N73-33632** Tetra Tech, Inc., Pasadena, Calif.
**MEDIUM AND SYSTEM TRANSFORM FUNCTIONS**
Willard H. Wells *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 16 p (For availability see N73-33619 24-23)

The application of Fourier techniques to calculate the spread of scattered light surrounding other distributions is discussed for cases of a circular spot, a beam with Gaussian profile, and a linear stripe. The quantities needed for round trip propagation from transmitter to receiver are defined. A formula for particle backscattering is developed. A table of blur and offset distributions and the related Fourier transforms and transfer functions is included. Author

**N73-33633** Tetra Tech, Inc., Pasadena, Calif.
**SOURCES: ARC, FLASH, INCANDESCENT AND LASER LAMPS** **c23**
Henri Hodara and Willard H. Wells *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 17 p refs (For availability see N73-33619 24-26)

The major classes of incoherent and coherent sources of light for underwater applications are discussed. A performance comparison figure for lamps is developed based on the square root of the round trip light attenuation from lamp to camera taking into account the source, the medium, and the receiver spectral sensitivity. It is stated that the selection of a lamp is dictated by efficiency. In that respect, incoherent sources are superior to lasers for most underwater illumination applications. Author

**N73-33634** Tetra Tech, Inc., Pasadena, Calif.
**RECEIVERS: PHOTOELECTRIC AND PHOTOGRAPHIC DETECTORS** **c09**
Henri Hodara and Willard H. Wells *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 15 p (For availability see N73-33619 24-23)

A procedure for comparing photo-electronic and photographic detectors is discussed. The criterion is based on the product of the signal to noise ratio and the spatial bandwidth. The subjects discussed are: (1) fundamentals for comparing detector performance, (2) units for measuring resolution, (3) characteristics of photoelectronic image detectors, and (4) characteristics of photographic film used with photoelectronic equipment. Author

**N73-33635** RCA Service Co., Inc., Patrick AFB, Fla.
**UNDERWATER LENSES AND OPTICAL PORTS**
Lawrence E. Mertens *In* AGARD Optics in the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 25 p refs (For availability see N73-33619 24-23)

Basic theoretical and practical aspects of using lenses and ports in underwater imaging systems are reviewed. Terminology is defined and formulas for estimating field of view, distortion and other aberrations are presented. Several types of optical systems for correcting aberrations are reviewed. The depth of field and relative aperture are compared for several lens port combinations. Applications of short focal length, long focal length, and supplementary lenses are reviewed. Author

**N73-33636** Tetra Tech, Inc., Pasadena, Calif.
**LONG RANGE VISION TECHNIQUES**
Willard H. Wells *In* AGARD Optics in the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 13 p refs (For availability see N73-33619 24-23)

Techniques for long range vision are discussed. Two methods, range-gating and dual-scan with parallax, are described. The treatment assumes unsaturated photoelectronic detectors that are limited by photon noise, not contrast. A range-gated system with radar-like pulses offers the ultimate solution for long range vision as far as eight attenuation lengths and beyond with badly degraded resolution. The best alternative to range-gating is a dual-scan system in which the illuminator and receiver are separated for parallax. The practical limit is about seven attenuation lengths unless range-gating is added to eliminate luminance in nearby water. Author

**N73-33637** Tetra Tech, Inc., Pasadena, Calif.
**SPATIAL FILTERING AND IMAGE RESTORATION**
Henri Hodara *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 12 p (For availability see N73-33619 24-23)

The exponential dependence of the ocean transfer function on range and the application to image restoration are discussed. An inverse filter to restore photographs of floodlit targets blurred by turbulence is described and the limitations are analyzed. The resolution degradation caused by a mismatch between filter and medium transfer functions is calculated. The signal to noise ratio required to achieve various restorations is analyzed. Author

**N73-33638** Tetra Tech, Inc., Pasadena, Calif.
**FORTRAN ALGORITHMS FOR UNDERWATER OPTICS**
Willard H. Wells *In* AGARD Optics of the Sea (Interface and In-Water Transmission and Imaging) Aug. 1973 17 p (For availability see N73-33619 24-23)

The application of FORTRAN algorithms for underwater optics is discussed. The functions performed by various subroutines are described. An example of a complete computer program is provided. The selected program has utility for fundamental studies of water properties. It accepts a number of point spread functions measured at different distances and computes the spatial frequency decay function from each of them. Author

**N73-33639#** Weapons Research Establishment, Salisbury (Australia).
**COMPLETE LISTING OF UPDATED RESULTS FROM FALLING SPHERE EXPERIMENTS CONDUCTED IN AUSTRALIA, MARCH 1962 - JUNE 1972**
P. H. O. Pearson and S. G. Johnson Jun. 1973 135 p refs (WRE-TN-799(WR/D)) Avail: NTIS HC $8.75

Successful experiments have been conducted in Australia during the past ten years to measure basic atmospheric parameters by means of the falling sphere technique. An inflatable sphere of 2m diameter was used to obtain the results which have been reported previously. In this document, revised information on the drag of spheres was incorporated to update the original results. All data are presented in tabular form at kilometer height intervals ranging between 30 and 100 km altitude. Author

**N73-33640*#** Linguistic Systems, Inc., Cambridge, Mass.
**ON ABSORPTION SPECTRA FOR CERTAIN RARE CRYSTALS AND THEIR MODIFICATIONS WITHIN A MAGNETIC FIELD AT THE TEMPERATURE OF LIQUID HELIUM**
Jean Becquerel, H. Kamerlingh Onnes, and W. J. DeHaas

Washington NASA Sep. 1973 7 p refs Transl. into ENGLISH from Compt. Rend., (Paris), v. 181, 16 Nov. 1925 p 758-760 (Contract NASw-2482)
(NASA-TT-F-14732) Avail: NTIS HC $3.00 CSCL 20L

Using a cryostat whose three tubes were filled, respectively, with helium, hydrogen, and nitrogen in liquid form, a spectrographic study was conducted of certain rare earth crystals, taking into account the particular effects produced by a temperature of 4.2 K (liquid helium). At that temperature, notably for zenotine, strong dissymetries appeared in the spectra for inverse circular vibration. As a result it was conclude that, at very low temperatures, the rule by which magnetic influence upon circular vibration intensifies as thermic agitation decreases loses a major portion of validity. Author

**N73-33641*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**A SURVEY OF INTEGRATED OPTICS WITH BIBLIOGRAPHY**
Robert B. Owen Sep. 1973 35 p refs
(NASA-TM-X-64787) Avail: NTIS HC $3.75 CSCL 20F

The field of integrated optics is surveyed. Light coupling into films, modulation of light propagating in films, and current integrated optics developments and devices are discussed. It is concluded that integrated optics technology is expected to revolutionize the electronics industry as completely as did microcircuit technology. An extensive bibliography for the field of integrated optics is included. Author

**N73-33642#** Tennessee Univ., Knoxville.
**ELECTRON HEATING BY MICROWAVES**
1972 10 p refs Presented at 1st Topic Conf. on RF Plasma Heating, Lubbock, Tex., 6-8 Jul. 1972 Prepared in cooperation with ORNL
(Contract AT(40-1)-2598)
(Conf-720705-8) Avail: NTIS HC $3.00

The microwave heating of electron plasmas is examined critically. The primary emphasis is on theory with some discussion of experimental results. The point of view which is presented most thoroughly is the process of resonant diffusion. New results are given for the heating of relativistic electrons. Author (NSA)

**N73-33643#** Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
**THEORY OF OPTICAL NONLINEAR SUSCEPTIBILITIES**
Christos Flytzanis Apr. 1973 315 p refs
(Contract N00014-67-A-0298-0006; NR Proj. 372-012)
(AD-764889; TR-638) Avail: NTIS CSCL 20/6

A comprehensive review is given of the nonlinear optical susceptibilities of atoms, molecules and condensed matter. Second and third order nonlinear electromagnetic response functions are treated over the entire frequency range from d.c. to the X-ray region. Both classical macroscopic theories and quantum mechanical microscopic theories are reviewed and compared with experimental results. Author (GRA)

**N73-33644#** Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
**IMAGE SUBTRACTION BY POLARIZATION-SHIFTED PERIODIC CARRIER Report for Jul. - Oct. 1972**
Stephen R. Dashiell and Adolf W. Lohmann 1 Aug. 1973 25 p refs
(Contract F04701-73-C-0074)
(AD-765174; TR-0074(4230-40)-1; SAMSO-TR-73-237) Avail: NTIS CSCL 20/6

A coherent image subtractor is described that makes use of a periodic carrier that is effectively shifted by one-half period by simple sheet polarizing material. As the system has two input stations, the two transparencies to be subtracted are simultaneously visible to facilitate alignment. Author (GRA)

**N73-33645#** Pomona Coll., Claremont, Calif. Dept. of Physics.
**PHASE DETECTION OF MAGNETO-OPTIC MAGNETIZATION SIGNALS**
Charles A. Fowler, Jr. 20 Jul. 1973 18 p refs
(Contract N00014-71-C-0148; NR Proj. 018-303)
(AD-764549; TR-12) Avail: NTIS CSCL 20/12

A method for recording the reversal of magnetization in ferromagnetic specimens by detecting the accompanying phase change of the magneto-optic light component (Kerr or Faraday) is described. The method uses polarized coherent illumination and involves the interference of the reflected (or transmitted) wave and a reference wave. For evaporated magnetic films that are transparently thin, a Twyman-Green interferometer arrangement is described. For thicker magnetic film specimens a technique involving holographic interferometry is employed. The magneto-optic signals accompanying magnetization reversal are observed with the conventional Kerr technique.
Author (GRA)

**N73-33646#** Army Foreign Science and Technology Center, Charlottesville, Va.
**STUDY OF CONTACT RESISTANCE IN THERMOELECTRIC MATERIALS**
E. N. Zvyagina 15 Mar. 1973 6 p refs Transl. into ENGLISH from the publ. "Nizkotemperaturnye Termoelektricheskie Materialy" Kiev, 1970 p 44-47
(AD-765769; FSTC-HT-23-2021-72) Avail: NTIS CSCL 20/3

In semiconducting thermoelectric batteries, contact electrical resistance arising when switching thermal elements decreases their effectiveness. A method for measuring contact resistances of the semiconductors is proposed that is based on an increase in the number of switching layers in a test piece. GRA

# 24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

**N73-33647** Princeton Univ., N.J.
**RHEOLOGICAL AND OPTICAL PROPERTIES OF DEFORMABLE PARTICLES IN LAMINAR SHEAR FLOWS Ph.D. Thesis**
Seung Jung Choi 1972 154 p
Avail: Univ. Microfilms Order No. 73-18755

Constitutive equations are derived for moderately concentrated solutions of Newtonian particles and for dilute solutions of viscoelastic particles which are suspended in an incompressible Newtonian fluid. The ellipticity of the deformed particle gives nonlinear effects in the macroscopic bulk stresses, which manifest non-Newtonian behavior in a time-dependent shear flow. For Newtonian particles, viscosity and normal stresses are obtained for both steady shear and elongational flows. Drop deformation and orientation of the particle are also discussed. For dilute solutions of viscoelastic particles, the Eulerian strain tensor and macroscopic bulk stress are obtained for both steady and oscillatory shear flows. For moderately concentrated solutions, dynamic viscosity and rigidity are obtained in oscillatory shear flows. Expressions for flow birefringence and extinction angle are obtained. Dissert. Abstr.

**N73-33648** Minnesota Univ., Minneapolis.
**TECHNIQUES FOR THE MEASUREMENT OF NARROW MASS DOUBLETS AND THEIR APPLICATION IN THE RARE EARTHS REGION Ph.D. Thesis**
David Charles Kayser 1973 103 p
Avail: Univ. Microfilms Order No. 73-18120

Precision mass measurements are concerned with three main topics: (1) Extending the effective resolution of a mass spectrometer beyond its normal operating resolution; (2) measurement of selected metal chloride and metal to hydrocarbon doublets of samarium and gadolinium to obtain improved masses and mass differences; and (3) a least squares adjustment in the region A = 141 to A 160 of the present mass data, other selected mass data and precise nuclear reaction data. Dissert. Abstr.

**N73-33649** Princeton Univ., N.J.
**POTENTIAL REPRESENTATIONS FOR THE CONTINUUM THEORY OF A DIATOMIC ELASTIC DIELECTRIC Ph.D. Thesis**

Michael Andrew Epton 1973 143 p
Avail: Univ. Microfilms Order No. 73-18790

In a diatomic substance, such as salt, it is useful to distinguish two displacement fields and two intrinsic polarization fields; one displacement field and one polarization field for each of the two types of atoms. Using Mindlin's theory for such a substance, three main topics are developed: (1) A potential representation theorem analogous to that of Papkovitch and Neuber in classical static elasticity is derived; (2) a potential representation for any solution to the dynamic equations is derived, and (3) solutions to several specific (static) boundary value problems are presented. Dissert. Abstr.

**N73-33650** University of Southern Calif., Los Angeles.
**RAMAN SCATTERING FROM LOCALIZED VIBRATIONAL MODES IN GALLIUM PHOSPHIDE AND DIELECTRIC PARAMETERIZATION OF RAMAN LINESHAPES OF PLASMON-PHONON COUPLED MODES Ph.D. Thesis**
David Takwei Hon 1973 139 p
Avail: Univ. Microfilms Order No. 73-18815

High frequency localized vibrational modes in chemical compounds are analyzed by Raman scattering techniques. Based on the approximate theory for mass defect localized vibrational modes, a calculation is presented and the results are compared with localized vibrational modes after the introduction of impurities. Several advantages of Raman scattering for analyzing impurities in semiconductors are examined. The Raman lineshapes for several samples of gallium phosphide with appreciable carrier concentrations were examined. The lack of plasma resonance in the scattering and the modified appearance of the LO photon are discussed. Author

**N73-33651** Illinois Univ., Urbana.
**NUCLEAR SPIN RELAXATION IN MAGNESIUM METAL Ph.D. Thesis**
Lewis Henry Zitzman 1972 150 p
Avail: Univ. Microfilms Order No. 73-17491

The nuclear spin-lattice relaxation time of Mg-22 in magnesium metal has been measured in the temperature range 2.0-4.2 K. The experimental measurements yield T sub 1 T = 65.5 + 1.1 (sec.-deg.). The nuclear spin-spin relaxation rate is found to have an exponential time dependence which corresponds to a Lorentzian shape of the homogeneous line. From this and the magnitude of the spin-spin relaxation time it is concluded that indirect nuclear coupling through the RKKY interaction narrows the linewidth over the theoretical dipolar value. The quadrupole-split inhomogenous lineshape has been measured. From the satellite peaks in the powder pattern a value of the quadrupole coupling parameter is obtained. Dissert. Abstr.

**N73-33652** Illinois Univ., Urbana.
**ENERGY DISTRIBUTIONS OF ELECTRONS IN RADIATION INDUCED-HELIUM PLASMAS Ph.D. Thesis**
Ronnie Hung-Kie Lo 1972 131 p
Avail: Univ. Microfilms Order No. 73-17304

Electron energy distributions resulting from a continuous primary source at high energies in helium have been calculated. Contributions from both the primary electrons and subsequent secondaries are included. In the cases analyzed, the primary electrons are taken to be produced via the ionization of helium by heavy charged particles from the nuclear reaction neutral n1 + 5 b10 yield 3 lif + 2 he4 which represents an important means of using the neutron flux from a nuclear reactor to produce a plasma. The calculation covers an energy range from zero to about 1 KeV, the highest energy of the primary electrons associated with such a source. Electron neutral collisions are assumed to be the dominate collision process. While this limits the fractional ionization to 0.00001, this region is of interest for application in areas such as radiation pumped lasers and the buffer gas region of the gaseous core nuclear reactor. Dissert. Abstr.

**N73-33653** Carnegie-Mellon Univ., Pittsburgh, Pa.
**A COLLISION PROBABILITY METHOD FOR CALCULATION OF ENERGY-DEPENDENT FLUX DISTRIBUTIONS IN MULTIDIMENSIONAL SYSTEMS WITH ARBITRARY BOUNDARY CONDITIONS Ph.D. Thesis**
Carl Anthony Detrick 1973 282 p
Avail: Univ. Microfilms Order No. 73-18322

A method has been developed for the calculation of local neutron fluxes and reaction rates in multidimensional systems directly from integral transport theory. The method is based on the first flight collision probabilities technique which described neutron transport by the probability for a neutron emitted in one location to travel without collision to another location and undergo its first collision at the second location. The first flight collision probabilities are used in neutron balance statements relating the integral number of collisions in each subdivision of the region of solution and the leakage out of the region to the neutrons emitted from scattering, fission, or fixed sources in all subdivisions. These balance statements provide a set of simultaneous equations. Dissert. Abstr.

**N73-33654** California Univ., Davis.
**K SHELL COMPTON SCATTERING ON TIN AND GOLD AT 145 kEV AND GOLD AT 320 keV Ph.D. Thesis**
Leon Arthur Wittwer 1972 66 p
Avail: Univ. Microfilms Order No. 73-19117

A numerical calculation is given for the inelastic K-shell cross-sections of tin with an incident energy of 145 keV and of gold at 145 and 320 keV. The calculation is based on second order perturbation theory. The bound initial state is the relativistic Hartree-Fock-Slater single particle 1S1/2 eigenfunction for the particular element concerned. The relativistic scattering solutions are constructed from continuum total spin eigenfunctions of the self-consistent potential field of the parent configuration. The necessity of using both negative and positive energy eigenfunctions is demonstrated when using the Dirac relativistic formalism. The calculated spectra are the sum of the Compton line and the infrared divergence with the Compton line being dominant. The Compton line displays the Compton defect and line broadening found at higher incident energies. The Compton line is also almost entirely due to negative energy intermediate state transitions. The infrared divergence, on the other hand, is due entirely to positive energy intermediate state transitions. Dissert. Abstr.

**N73-33655** Illinois Univ., Urbana.
**SPIN ECHO DOUBLE RESONANCE STUDY OF DILUTE MAGNETIC ALLOYS Ph.D. Thesis**
James Buckley Boyce 1972 161 p
Avail: Univ. Microfilms Order No. 73-17130

Both the impurity and host resonances have been investigated at liquid helium temperatures in three dilute magnetic alloys: CuCo, AlMn, and CuV. The impurity resonances have been observed using spin echoes. The Knight shifts of Co in Cu and Mn in Al agree with already published results. The Knight shift of V in Cu is .123 + or - .013%. The host resonance of a shell of neighbors to the impurity has been observed in all the samples using the spin echo double resonance method. The satellite in CuCo is due to the first shell of neighbors to the impurity. Dissert. Abstr.

**N73-33656*#** National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
**IS NUCLEAR MATTER A QUANTUM CRYSTAL?**
V. Canuto and S. M. Chitre [1973] 58 p refs
Avail: NTIS HC $5.00 CSCL 20H

A possible alternative to the ordinary gas-like computation for nuclear matter is investigated under the assumption that the nucleons are arranged in a lattice. BCC, FCC and HCP structures are investigated. Only HCP shows a minimum in the energy vs. density curve with a modest binding energy of -1.5 MeV. The very low density limit is investigated and sensible results are obtained only if the tensor force decreases with the density. A study of the elastic properties indicates that the previous structures are mechanically unstable against shearing stresses. Author

**N73-33657#** Illinois Univ., Urbana. Dept. of Physics.
**A MODEL FOR P-P DIFFRACTION**
Mark Davidson Oct. 1973 19 p refs
(Ill-(TH)-73-15) Avail: NTIS HC $3.00

Previous work on pi-pi scattering is generalized to include the P-P case. A fixed pole solution is found for the P-P scattering amplitude. After approximating the residue of this pole, it is compared with high energy data from the Cern I.S.R. The one parameter model explains several aspects of this data. Author

**N73-33658#** Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
**NEW PRINCIPLE OF RECORDING THE PARTICLE TRACKS IN LIQUID AND CRYSTALLINE MEDIA**
A. F. Pisarev 1973 14 p refs In RUSSIAN
(JINR-P13-7067) Avail: AEC Depository Libraries HC $3.00

A new principle is introduced and analyzed for particle track recording in liquid and solid media by means of selective resonance pumping of energy at the place of breaking the media structure by particle tracks and by generation (in their neighborhood) of optical inhomogeneities of visible size. In particular, it is shown that by using the ortho-para-transition of molecules one can construct liquid-and solid-hydrogen track chambers with a selective control regime and a memory time of 0.000001 to 10 to the minus seventh power and a reconstruction time of 0.00001 to 0.0000001. Author (NSA)

# 25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

**N73-33659** Florida Univ., Gainesville.
**IMPROVEMENTS IN THE RELAXATION THEORY OF SPECTRAL LINE BROADENING IN PLASMAS Ph.D. Thesis**
Joseph Edward Whalen 1972 174 p
Avail: Univ. Microfilms Order No. 73-15606

Several improvements in previous treatments of the relaxation theory of spectral line broadening in a plasma are presented. These are: (1) To second order in the coupling constant, the theory is extended to included ion-field effects in the atomic Boltzmann factors and the electron collision operators. (2) The theory is extended to include full Coulomb interaction between the radiating atoms and the perturbing electrons. (3) The effect of using a strong collision cut-off on the theoretical computations is examined. (4) The effects of electron symmetry are introduced through an effective Boltzmann distribution. (5) A static wing formula is developed. The calculated results using the static wing formula are compared with the experimental data for frequency separations greater than the electron plasma frequency. This theory provides an inexpensive means for computing wing profiles which may be useful to experimentalists and astrophysicists.
Dissert. Abstr.

**N73-33660** New York Univ., N.Y.
**COMPUTER SIMULATED NONLINEAR IMPULSE RESPONSE OF INHOMOGENEOUS PLASMA SLAB Ph.D. Thesis**
Jeffrey Nathaniel Brooks 1973 123 p
Avail: Univ. Microfilms Order No. 73-19378

The response of an inhomogeneous plasma to strong, initial impulse electric field excitation has been studied by means of a sheet model computer simulation. Runs were made for both cold and warm plasmas having a cosine like density background. Strong nonlinear effects are observed, as well as phenomena distinctly attributable to the inhomogeneity. These include a non-monotonic voltage decay rate, complex mode structure of the electric fields, and strong density peaks. An increase in thermalization occurs in all cases. Dissert. Abstr.

**N73-33661** Maryland Univ., College Park.
**TIME-RESOLVED SPECTROSCOPY OF A HIGH TEMPERATURE, HIGH DENSITY PLASMA IN A VACUUM SPARK Ph.D. Thesis**
John J. Turechek 1972 92 p
Avail: Univ. Microfilms Order No. 73-18747

The results of time-resolved spectroscopic measurements from the near infrared to the X-ray region of the emission from a low-inductance, high-current vacuum spark are reported. By varying the discharge parameters the operation of the device was optimized to produce a small plasma focus with reproducible temperatures of 30 keV, densities better than 10 to the 20th power cu/cm, and containment times as high as 20 nanoseconds. X-ray spectra from helium-like and hydrogen-like ions were observed for elements of nuclear charge as high as that of molybdenum, and these correspond to the highest ionization stages heretofore reported in a laboratory plasma. The wavelengths and intensities of the line spectra of these ions are compared with theoretical predictions and the presence of unexpected features is noted. A history of the spark and a summary of the literature on the theory of its operation are included. Dissert. Abstr.

**N73-33662** California Inst. of Tech., Pasadena.
**DAMPING AND SATURATION OF A SECOND ORDER ELECTRON PLASMA WAVE ECHO Ph.D. Thesis**
Charles Porter Moeller 1973 94 p
Avail: Univ. Microfilms Order No. 73-18377

Experimental work is described on the damping of a second order electron plasma wave echo due to velocity space diffusion in a low temperature magnetoplasma. Sufficient precision was obtained to verify the theoretically predicted cubic rather than quadratic or quartic dependence of the damping on exciter separation. Compared to the damping predicted for Coulomb collisions in a thermal plasma in an infinite magnetic field, the magnitude of the damping was approximately as predicted, while the velocity dependence of the damping was weaker than predicted. The discrepancy is consistent with the actual non-Maxwellian electron distribution of the plasma. In conjunction with the damping work, echo amplitude saturation was measured as a function of the velocity of the electrons contributing to the echo. Good agreement was obtained with the predicted J sub 1 Bessel function amplitude dependence, as well as a demonstration that saturation did not influence the damping results.
Dissert. Abstr.

**N73-33663** Wisconsin Univ., Madison.
**A STUDY OF THE FEASIBILITY OF FUSION TORCHES Ph.D. Thesis**
Zeinab Abdelsalam Sabri 1972 733 p
Avail: Univ. Microfilms Order No. 73-10737

Docility in design and malleableness in application of fusion torches are discussed. The need to exploit plasmas within the fusion range which are not yet explored by industry is examined together with a comparison between contemporary plasma jets and fusion torches. Three types of torches are considered for investigation; (1) an R-torch utilizing the exhaust of a thermonuclear reactor, (2) an S-torch employing a specially designed plasma source, and (3) an Sc-torch using no external source. Merits of plasmas as processing media are pointed out. The capability of the fusion torches to perform as separation devices is examined and the search for the most apropos technique is conducted. Difficulties and drawbacks associated with the existing methods of separation are scrutinized in order to provide conditions for significant improvement. Dissert. Abstr.

**N73-33664** Illinois Univ., Urbana.
**MEASUREMENT OF ELECTRON DENSITY IN A CYLINDRICAL ELECTROSTATIC CONFINEMENT DEVICE Ph.D. Thesis**
Donald Joseph Meeker 1972 85 p
Avail: Univ. Microfilms Order No. 73-17323

Experimental investigations are given on spatial variation in electron density in a cylindrical electrostatic confinement device. Electrostatic confinement is one method of many proposed to contain a plasma at fusion conditions. The model hypothesized for describing the confinement principle of containing a fusionable gas requires an alternating structure in net charge in the center of the device and a trapping of charged particles by these alternating charge layers. Two diagnostic methods were used to investigate the charge structure: microwave signals of 4 and 8 mm wavelengths employing both longitudinal and transverse modes to measure the average electron density, and a laser heterodyne system at a wavelength of 3.39 microns to spatially resolve the electron density distribution by scanning the discharge. Dissert. Abstr.

**N73-33665** Texas Univ., Austin.
**MEASUREMENT OF TURBULENCE WITHIN COLLISIONLESS PLASMA SHOCKS USING COLLECTIVE SCATTERING OF RUBY LASER LIGHT Ph.D. Thesis**
Milton David Machalek 1972 111 p
Avail: Univ. Microfilms Order No. 73-18464

Experimental data were obtained on the character of the

turbulence contributing to heating of plasma in collisionless shock waves. Frequency, wavelength, and directions of propagation of turbulence waves in shocks moving perpendicular to an initial magnetic field were measured in oblique plasma shock. The diagnostic technique of forward scattering of ruby laser light was employed to obtain wavelength and frequency spectra of the turbulence. A He-Ne laser monitored Fabry-Perot etalon system was used to measure the scattered light Doppler shift, from which was deduced the frequency of turbulence waves. Scattered light was analyzed and shifts of approximately 0.02 A were obtained. The evidence gathered reinforces the theory that turbulence waves in collisionless shocks are current driven waves, supported by electrons and grown to nonlinearity, randomizing the directed energy of plasma entering the shock region.
Dissert. Abstr.

**N73-33666** Texas Univ., Austin.
**MODE CONVERSION AT THE LOWER HYBRID PLASMA RESONANCE Ph.D. Thesis**
Barry Newton Moore 1972 229 p
Avail: Univ. Microfilms Order No. 73-18473

The process of mode conversion, or linear wave transformation, near the lower hybrid resonance layer of a warm, inhomogeneous plasma is investigated theoretically. It is assumed that the density gradient is small and that second order Larmor radius effects can be neglected, but the effects of both collisional and non-collisional damping are included. Integral transform methods are used to obtain approximate wave solutions for both perpendicular and oblique propagation directions with respect to the static magnetic field. All of the Stokes regions are identified and the complete set of connection equations is derived. It is shown that these imply that, as long as there is negligible damping and the plasma is semi-infinite, all incident long wavelength energy is completely converted into short wavelength energy for both oblique and perpendicular propagation. However, it is also demonstrated that the conversion efficiency is exponentially decreased by any damping process at the critical layer and any reduction in the magnitude of the density gradient.
Dissert. Abstr.

**N73-33667** California Univ., Los Angeles.
**LINEAR AND NONLINEAR THEORY OF HALL CURRENT INSTABILITY Ph.D. Thesis**
Kenneth Lee 1972 142 p
Avail: Univ. Microfilms Order No. 73-10441

A plasma instability due to a current flowing perpendicular to earth's magnetic field has been accepted as the generation mechanism of enhanced electron density fluctuation observed by backscattering experiments at the magnetic equator. The observations of constant Doppler frequency shift for the spectral peak is unexplained by existing theories. To explore the possibility of providing better agreement between observations and theory, existing linear theory and nonlinear theories are extended. The linear instability theory is generalized to include wave propagation and refraction. The integrated growth of waves along their ray paths are computed to provide at each altitude an angular wave spectral distribution relative to the direction of the current flow. The final fluctuation spectrum is shown to be a one-dimensional spectrum in the horizontal direction and cannot be detected by backscattering experiments. Dissert. Abstr.

**N73-33668** Maryland Univ., College Park.
**INVESTIGATION OF AN RF PRODUCED NONNEUTRAL HOT ELECTRON PLASMA Ph.D. Thesis**
Neville Clinton Luhmann, Jr. 1973 243 p
Avail: Univ. Microfilms Order No. 73-18740

To investigate the properties of an rf produced, magnetically confined nonneutral hot electron plasma, a low energy (approximately 1 keV), low current (approximately 0.06 A) electron beam was injected along the axis of an evacuated right circular cylindrical cavity resonator situated in an axial magnetic mirror field. In order to investigate the motion of electrons in the large amplitude fields of this cavity, the relativistic (neglecting the radiation reaction force) single particle equations of motion were integrated numerically for the cases of a cavity resonator immersed in a uniform magnetic field, a magnetic mirror field, and combined mirror - quadrupole magnetic field. Dissert. Abstr.

**N73-33669*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**A PULSED XENON MEGAWATT ARC PLASMA SOURCE**
Charles J. Michels 1973 12 p refs Presented at 26th Ann. Gaseous Electronics Conf., Madison, Wisc., 16-19 Oct. 1973; sponsored by Am. Phys. Soc.
(NASA-TM-X-71443; E-7702) Avail: NTIS HC $3.00 CSCL 20I

The exhaust of the source flowing into vacuum was measured by Thomson scattering diagnosis. Mean electron temperatures and densities were found to be 4-8 eV and of order ten to the 13th power cm/3 respectively over the 8 cm exhaust diameter at 30 cm from the source. Large shot to shot variations were noted. After a transient spike passes, these conditions persist during the power time of 125 microsecond. These exhaust conditions are marginal for evaluation of a proposed near resonant charge exchange pumped laser theory. Author

**N73-33670*#** Linguistic Systems, Inc., Cambridge, Mass.
**ON THE SELECTION OF SIMILARITY CRITERIA FOR A STREAM OF PLASMA FLYING INTO A MAGNETIC DIPOLE**
V. M. Smirnov Washington NASA Oct. 1973 12 p refs Transl. into ENGLISH from Fiz. Plazmy (USSR), no. 3, 1971 p 70-76
(Contract NASw-2482)
(NASA-TT-F-15057) Avail: NTIS HC $3.00 CSCL 20I

A mathematical model is developed for describing the effect of the solar wind on the earth's magnetosphere. The model consists of a uniform stream of balanced ions with mass, density, velocity, and charge coming from infinity and passing by the equatorial plane of a magnetic dipole. Author

**N73-33671#** Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Inst.
**CONCERNING ASYMPTOTIC SOLUTIONS OF NONLINEAR EQUATIONS OF AUTO-OSCILLATIONS OF A PLASMIC LAYER**
V. A. Zherebtsov and A. V. Shutko 1972 28 p refs In RUSSIAN
(FEI-359) Avail: AEC Depository Libraries HC $3.50

Methods of constructing asymptotic solutions of nonlinear equations which describe auto-oscillations in a finite, continuous medium are describe. The methods developed are generalized from the methods of Krylova-Bogolyubov and Lyapunoba-Puankare. Cases of auto-oscillations in a plasma layer are considered in detail. Author (NSA)

**N73-33672#** Akademiya Nauk URSR. Kiev. Inst. Teoreticheskoi Fiziki.
**NONLINEAR WAVE INTERACTION AND FLUCTUATIONS IN PLASMA**
A. G. Sitenko 1973 20 p refs
(ITF-73-8-E) Avail: AEC Depository Libraries HC $3.00

Collective fluctuations in nonequilibrium plasma with nonlinear wave interaction are considered. The four wave interaction is the main nonlinear effect when three wave resonances are absent. This interaction causes an eigenfrequency shift proportional to the oscillation intensity. The proportionality coefficient is determined by nonlinear susceptibilities of plasma. The spectral distribution of field fluctuations is derived with the Langmuir oscillation frequency nonlinear shift taken into account. It is shown that a stationary turbulent state of plasma with the fluctuational Langmuir oscillation level much greater than the thermal one is possible. Author (NSA)

**N73-33673#** Akademiya Nauk URSR, Kharkov. Fiziko Technicheskii Inst.
**INTERACTION OF FINITE-AMPLITUDE WAVES WITH A PLASMA**
V. D. Shapiro and V. I. Shevchenko 1972 79 p refs In RUSSIAN
(KHFTI-72-24) Avail: AEC Depository Libraries HC $6.00

Basic results concerning nonlinear theory of resonance excitation and the attenuation of plasma and monochromatic electromagnetic waves are reviewed in the literature. Various mechanisms for the instability of monochromatic waves in a plasma are examined, as well as the transition toward a single

mode regime which is caused by these instabilities.
Author (NSA)

**N73-33674#** Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
**USE OF RESONANCE FOR THE DYNAMIC STABILIZATION OF THE RAYLEIGH-TAYLOR INSTABILITY AND FOR THE EXCITATION OF THE RELATED PARAMETRIC INSTABILITIES**
H. Holitzer and G. H. Wolf Feb. 1973 11 p refs
(IPP-2/209) Avail: AEC Depository Libraries HC $3.00

The dynamic stabilization of the hydrostatic Rayleigh-Taylor instability and the excitation of the related short wavelength parametric instabilities require the application of enforced oscillations vertically to the unstable interface. The use of the resonance between the frequency of these oscillations and the appropriately chosen eigenfrequency of the overall system allows operation in regions of the stability regime which are difficult to reach otherwise. An air cushion between the body of liquid and the vibrator which delivers the enforced oscillations can be used as the spring determining this eigenfrequency instead of the familiar mechanical elements. Author (NSA)

**N73-33675#** Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
**STABILITY OF TWO-DIMENSIONAL COLLISION-FREE PLASMAS**
K. Schindler, D. Pfirsch, and H. Wobig Feb. 1973 43 p refs
(IPP-6/117) Avail: AEC Depository Libraries HC $4.25

The stability of plasma equilibria is analyzed in the framework of two-dimensional Vlasov theory, where the perturbations are constant along the direction of the equilibrium current. The method makes use of several general properties of the equations, thus covering a rather large class of different configurations. Several necessary and sufficient stability criteria and an expression for the growth rates are derived. In particular, the results are applicable to equilibria containing neutral points. A number of earlier results are recovered by appropriate specialization.
Author (NSA)

**N73-33676#** Japan Atomic Energy Research Inst., Tokyo. Thermonuclear Fusion Lab.
**[RESEARCH ON TOKAMAKS, PLASMA CONFINEMENT AND INSTABILITIES, AND DIAGNOSTICS] Annual Report, period enging 31 Mar. 1972**
Oct. 1972 65 p refs
(JAERI-M-5029) Avail: AEC Depository Libraries

Works carried out in the JAERI thermonuclear fusion laboratory for the period of April, 1971 to March, 1972 are described. These include research on Tokamaks, plasma confinement and instabilities, and diagnostics. NSA

**N73-33677#** Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
**DIGITAL SIMULATION OF THE INTRODUCTION OF COLD OR ENERGETIC NEUTRAL PARTICLES INTO A HOT PLASMA**
J. P. Boujot, C. Mercier, J. P. Morera, and Soubbaramayer Jan. 1973 51 p refs In FRENCH
(EUR-CEA-FC-683) Avail: AEC Depository Libraries HC $4.75

A simplified digital code for studying the evolution of a plasma in a Tokamak device was presented earlier. This code is completed by analyzing the effects due to cold or energetic neutral particles. Two versions are presented: a complete version in which the Maxwellian velocity distribution at each point is taken into consideration; a simplified version in which only mean velocities are considered. The new code is coupled with the antecedent code in order to evaluate the matter and energy sources and sinks necessary to account for the evolution of the plasma. The code also gives the velocity spectrum of the neutral particles leaving the plasma. NSA

**N73-33678#** Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
**STUDY OF THE EVOLUTION OF A PLASMA NEAR A NEUTRAL POINT IN A MAGNETIC FIELD Ph.D. Thesis**
J. PantusoSudano Jan. 1973 26 p refs In FRENCH
(EUR-CEA-FC-685) Avail: AEC Depository Libraries HC $3.50

Exact analytical solutions near a neutral point for the LandauLifshitz magnetohydrodynamic equations were sought. Ordinary differential equations were solved for particular cases, and the results obtained were compared with those of other workers. The effects of a magnetic field, the electric conductivity, the homogeneous viscosity, and the choice of different initial conditions were studied. NSA

**N73-33679#** Nancy Univ. (France).
**MATHEMATICAL MODELS FOR NONCOLLISIONAL PLASMAS**
Pierre Bertrand 1972 157 p refs In FRENCH
(FRNC-TH-329) Avail: AEC Depository Libraries HC $10.00

The complexity of the Vlasov equation for noncollisional plasmas led to the use of an analytical digital philosophy in which the phase and velocity spaces were considered to be discrete. The water bag model was employed, this model having characteristics intermediate between those of Lagrangian and Eulerian plasma models. The basic hypothesis of the model consists of considering the distribution function to have constant values in certain regions of phase space. The hypothesis at t0 = 0 remains valid as a result of the Vlasov equation. The simple water bag model is rigorous for initial conditions of the f A type. In addition it provides a very good approximation for long wavelength phenomena under adiabatic conditions. NSA

**N73-33680#** Kernforschungsanlage, Juelich (West Germany).
**INFORMATION CONFERENCE, DATA PROCESSING IN RESEARCH**
H. W. Omeler, ed. Oct. 1972 218 p refs In GERMAN and ENGLISH Conf. held at Juelich, W. Ger., 12 - 13 Oct. 1972
(JUL-CONF-7; Conf-721083) Avail: NTIS HC $13.00

The discussion includes the Euler procedure, the difference procedure, the Lagrange procedure, the sheet model, the particle cell method, Landau damping, two-stream instability, and the plasma sphere. NSA

**N73-33681#** Los Alamos Scientific Lab., N.Mex.
**NONLINEAR DIFFUSION OF PULSED MAGNETIC FIELDS IN PLANAR AND CYLINDRICAL PLASMAS**
A. Haberstich Jun. 1973 13 p refs
(Contract W-7405-eng-36)
(LA-5132-MS) Avail: NTIS HC $3.00

The one dimensional, one component, nonlinear diffusion of pulsed magnetic fields in planar and cylindrical geometries is examined. The diffusion coefficient mu depends abruptly on the current density j associated with the gradient of the magentic field. The coefficient mu is large when j greater or equal to j sub 1, small when j smaller than or equal to j sub 2, and depends linearly on j in the interval j sub 2 smaller than or equal to j sub 1, where j sub 1 and j sub 2 are given current densities. A traveling wave solution is obtained in planar geometry and it is found that the product muj remains continuous in space in the limit (j sub 1 - j sub 2) yields 0. Analytic and finite-difference solutions of the traveling wave problem are compared, numerical stability conditions are found, and an estimate of the numerical error is obtained. The pulsed magnetic field problem is then solved numerically in the two geometries.
Author (NSA)

**N73-33682#** California Inst. of Tech., Pasadena.
**PLASMA WAVES Progress Report, 15 May 1972 - 15 Feb. 1973**
R. W. Gould Mar. 1973 34 p refs
(Contract AT(04-3)-767)
(CALT-767-P-2-X-2) Avail: NTIS HC $3.75

Research summaries are given for the following problems: (1) Effect of velocity space diffusion on the degradation of plasma wave echoes and an experimental determination of the velocity space diffusion coefficient; (2) thresholds for onset of parametric instabilities; and (3) propagation and absorption of waves near the lower hybrid frequency. NSA

**N73-33683#** California Univ., Livermore. Lawrence Livermore Lab.
**NEW MATERIAL PREPARED FOR PRESENTATION DURING FORTHCOMING EUROPEAN TRIP**
J. W. Shearer 22 May 1973 22 p

(Contract W-7405-eng-48)
(UCID-16272) Avail: NTIS HC $3.25

Lists, with texts, of figures and slides prepared for presentation at Culham, England are presented. These deal mainly with laser beam interactions with plasma and associated instabilities. NSA

**N73-33684#** Los Alamos Scientific Lab., N.Mex.
**ENERGY LOSS OF A RELATIVISTIC ELECTRON BEAM IN A PLASMA**
R. A. Gerwin May 1973 15 p refs
(Contract W-7405-eng-36)
(LA-5269-MS) Avail: NTIS HC $4.00

The energy loss of a finite-radius, finite-length, low-density, relativistic electron beam propagating through a resistive, infinite, field free plasma is considered. A unified calculation of the energy loss to both longitudinal and transverse plasma disturbances is presented, wherein are incorporated the exact solutions of Maxwell's equations coupled to a linearized cold-plasma model. In the appropriate parameter range, the results are in essential agreement with the work of Lovelace and Sudan, but encompass a broader parameter range. It is noted that the condition usually stated for the validity of the linearized plasma dynamics, beam density and plasma density is insufficient. Author (NSA)

**N73-33685#** California Univ., Livermore. Lawrence Livermore Lab.
**COMPARISON OF LASER-HEATED FUSION PLASMA PROPOSALS**
J. W. Shearer 10 Mar. 1973 6 p refs Presented at 6th European Conf. on Controlled Fusion and Plasma Phys., Moscow, 30 Jul. - 3 Aug. 1973 Sponsored by AEC
(UCRL-74628; Conf-730705-9) Avail: NTIS HC $3.00

In recent years, high-power lasers have become an important potential tool for manipulating fusion plasmas. Several fusion plasma proposals involving laser radiation are briefly reviewed. Author (NSA)

**N73-33686#** Los Alamos Scientific Lab., N.Mex.
**MAGNETOSPHERIC PLASMA FLOW AND THE NATURE OF THE MAGNETOSPHERIC BOUNDARY LAYER**
E. W. Hones, Jr. [1973] 28 p refs Presented at 7th ESLAB Symp. on Correlated Interplanet. and Magnetospheric Observations, Saulgau, West Germany, 22 May 1973 Sponsored by AEC
(LA-UR-73-732; Conf-730539-1) Avail: NTIS HC $3.50

Bulk flow of plasma in the outer magnetosphere has been studied using measurements of protons made with electrostatic analyzers on the Vela satellites. The flow is detected, and its velocity is measured by the spin modulation it causes in the response of the analyzers on the rotating satellites. Very rapid flow of plasma in the magnetotail plasma sheet occurs during magnetospheric substorms. As the plasma sheet thins early in a substorm expansion phase, bulk flow in the anti-earthward direction at several hundred kilometers per second is sometimes detected, possibly indicating the formation of a neutral line. As the satellites pass from the magnetotail to the magnetosheath, they traverse a boundary layer, whose thickness ranges up to a few thousand kilometers. Author (NSA)

**N73-33687#** Oak Ridge National Lab., Tenn.
**PHYSICS OF TARGET PLASMAS IN MINIMUM-B GEOMETRIES**
W. B. Ard, R. J. Colchin, E. C. Crume, J. L. Dunlap, G. R. Haste, N. H. Lazar, and J. F. Lyon 1973 7 p Sponsored by AEC
(Conf-730705-1) Avail: NTIS HC $3.00

Experiments were performed in the IMP facility, where superconducting mirror and quadrupole windings provide a variety of field configurations. The microwave sources have frequencies of 36 and 55 GHz. The power at 36 GHz is used for resonant heating and that at 55 GHz for upper off-resonant heating. Density profiles are shown for typical experiments. NSA

**N73-33688#** Israel Atomic Energy Commission, Yavneh. Soreq Nuclear Research Center.
**SELECTED BIBLIOGRAPHY ON PLASMA PRODUCTION BY LASERS**
S. Weill, comp. Jan. 1973 89 p refs
(LS-255) Avail: AEC Depository Libraries HC $6.50

The 705 items listed cover the years 1969-1972. A very few earlier items and the main coverage for the years prior to 1969 are also included. The compilation is based on two sources: NSA, and the Plasma Physics index, both for the years 1969-1972. Only bibliographic data are given, without abstracts. The entries are listed alphabetically according to the first author. A key to the abbreviations, an alphabetical index of co-authors, and a subject index are given. Author (NSA)

**N73-33689#** Paris Univ., Orsay (France).
**STUDY OF A NONLINEAR DIFFUSION PROBLEM RELATED TO PLASMA PHYSICS Ph.D. Thesis**
J. P. Saussais 1972 69 p refs In FRENCH
(FRNC-TH-371) Avail: AEC Depository Libraries HC $5.50

A macroscopic study is presented on the spatiotemporal evolution of a plasma confined in a toroidal magnetic enclosure. The magnetohydrodynamic system of equations was used as a starting point. It is assumed that the temporal variation in the density is negligible and that the fluid is at rest. Only the evolution of the temperature and electric current is investigated; it is also assumed that the toroidal effect is negligible, thus permitting the torus to be considered as an infinite cylinder. The stationary equations associated with the single fluid model (nonlinear eigenvalue problems) are studied. The single fluid model equations are made discrete and the stability studies using an implicity finite difference scheme. The same investigations are re-considered for a two-fluid system. The numerical results obtained for the different problems studied are presented in graphical form. NSA

**N73-33690#** Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
**HEATING OF A PLASMA BY THE INJECTION OF FAST HELIUM ATOMS**
J. P. Girard Jan. 1973 25 p refs In FRENCH; ENGLISH summary
(EUR-CEA-FC-682) Avail: AEC Depository Libraries HC $3.25

The injection of fast neutral particles appears to be a useful way of heating the plasma confined in a Tokamak. The advantages of injecting helium atoms instead of hydrogen atoms were demonstrated: preferential heating of the plasma ions; suppression of losses from fast ions by charge exchange, possible increase in the critical injected current, and absence of runaway helium ions. In addition, the high neutralization efficiency of helium ions up to high energies favors their use in reactors. The main disadvantages reside in the difficulties associated with pumping the helium and avoiding the pollution of the Tokamak vacuum enclosure. NSA

**N73-33691#** Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
**EFFECT OF COULOMBIAN COLLISIONS ON THE CONFINEMENT OF PLASMAS BY MIRROR MAGNETIC CONFIGURATIONS**
F. Werkoff Feb. 1973 113 p refs In FRENCH; ENGLISH summary
(EUR-CEA-FC-687) Avail: AEC Depository Libraries HC $7.75

Coulomb collisions are the principal cause of rapid losses of charged particles from mirror magnetic configurations. Charged-particle collisions are described by the Fokker-Planck coupled equations, equations which can only be solved numerically in the case of simplified theoretical models. The different models used up until the present day to describe hot ion plasmas are reviewed together with the results obtained with these models. One of these models was used to numerically simulate the time behavior of a hot-electron plasma. A theoretical model was developed that takes into account the anisotropies of the slowing down and diffusion coefficients of the Fokker-Planck equation. The model enabled calculations to be made of the density and confinement time for the particles of hot ion plasmas. In addition, calculations were made on the effect of anisotropies of the diffusion and slowing down coefficients on the power amplification factor Q in a thermonuclear reactor. Author (NSA)

**N73-33692#** Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

**BEHAVIOR OF THE PLASMA IN THE HARMONICA-TWO MACHINE**

P. Ginot and P. Plinate Feb. 1973 62 p refs In FRENCH; ENGLISH summary

(EUR-CEA-FC-660) Avail: AEC Depository Libraries HC $5.25

The most recent experimental results obtained with the Harmonica-Two machine (a variable curvature torus) are given together with an overall survey of all the experimental work carried out. Large helical perturbations of the plasma column are observed. These perturbations agree with theoretical predictions concerning their modes and phases when the rotational transform is about 2, the value for which the magnetic lines of force spiral in resonance with the curvature of the torus. The experimental conditions are too crude to enable observations to be made of more delicate phenomena such as macroscopic stability zones. The plasma is in fact in constant interaction with the walls. NSA

**N73-33693#** Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

**STOCHASTIC THEORY FOR HIGH TURBULENCE IN PLASMAS USING THE VLASOV APPROXIMATION**

J. H. Misguich Feb. 1973 23 p refs In FRENCH; ENGLISH summary

(EUR-CEA-FC-690) Avail: AEC Depository Libraries HC $3.25

The Vlasov equation for a plasma in a stochastic external field enables a closed evolution equation to be deduced for the mean distribution function in which the fluctuating component of the self-consistent field due to the action of the stochastic field on the distribution function is explicitly taken into account. This equation generalizes the Weinstock equation for the case of a stochastic external field. Three different expressions are given for this equation: in terms of the Weinstock propagator, the Vlasov propagator, and the Benford and Thomson propagator. This last expression enables a simple definition to be given for the stochastic quasi-linear approximation. This approximation takes into account the effect of the mean self-consistent field on the free particle trajectories and thus represents the analogue of the Dupree equation in the stochastic case. Author (NSA)

**N73-33694#** Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

**MILLIMETER WAVE POLARIMETERS AND THE COTTON-MOUTON EFFECT IN PLASMAS Ph.D. Thesis - Paris Univ.**

J. Mendonca Dec. 1972 129 p refs In FRENCH

(EUR-CEA-FC-675) Avail: AEC Depository Libraries HC $8.50

Two types of millimeter- and submillimeter-wave polarizers (constructed in the form of oversized circular guides) are presented. The conception of these polarizers was inspired by infrared techniques (metallic grids and dielectric plates used at Brewster incidence). The transmission and reflection of a wave by these two types of obstacle were studied, an analogy being made with classical transmission line theory. The performance of these polarizers was studied. Problems encountered in measuring the polarization of millimeter waves (in particular slightly elliptical waves) are examined. The efficiency of the polarizers was demonstrated from Cotton-Mouton (Voigt effect) measurements made in a dense plasma in the presence of an intense magnetic field. Calculations of the polarization of a wave propagated through the plasma in an undefined direction with respect to the magnetic field are presented. The geometrical optics approximation in a cold plasma was used; the Cotton-Mouton effect appears as a special case in the calculation. Experimental studies of this effect in a microwave frequency argon plasma discharge are described. NSA

**N73-33695#** Commissariat a l'Energie Atomique, Limeil-Brevannes (France). Centre d'Etudes Nucleaires.

**THEORETICAL STUDY OF LASER-CREATED PLASMAS CONFINED BY AN EXTERNAL MAGNETIC FIELD Ph.D. Thesis - Paris Univ.**

J. Martineau Jun. 1973 84 p refs In FRENCH

(CEA-R-4410) Avail: AEC Depository Libraries HC $6.25

The heating of a deuterium laser-created plasma from solid pellets confined by strong magnetic fields was studied. Ionization phase is taken into account. The inverse-bremsstrahlung absorption mechanism and induced Compton effect are the main heating processes. Using an inhomogeneous hydrodynamic model to describe the plasma dynamics, the skin depth due to the diffusion of the magnetic field inside the plasma is calculated. The efficiences for CO2 lasers and neodymium glass lasers are compared. NSA

**N73-33696#** Massachusetts Inst. of Tech., Cambridge. Lab. for Plasma Physics.

**[WORK IN PLASMA PHYSICS] Annual Progress Report, 1 Sep. 1972 - 31 May 1973**

J. E. McCune and D. J. Sigmar 1973 8 p refs

(Contract AT(11-1)-2168)

(COO-2168-5) Avail: NTIS HC $3.00

Summaries of work during this period are given for the following: (1) Theory of drift universal and drift cone modes of collisionless plasma in cylindrical geometry; (2) effects of plasma inertia on toroidal confinement; and (3) neoclassical transport theory of multispecies plasmas. NSA

**N73-33697#** California Univ., Livermore. Lawrence Livermore Lab.

**REVIEW OF PELLET CONCEPT: MOTIVATION FOR PLASMA PHYSICS STUDIES**

S. E. Bodner 19 Mar. 1973 12 p Presented at Phys. Dept. Colloq., Iowa Univ., Iowa City, 19 Mar. 1973

(Contract W-7405-eng-48)

(UCID-16222; Conf-730335-1) Avail: NTIS HC $3.00

A brief review of the laser-pellet fusion concept is given. Absorption mechanisms, electron mean free path problems, and plasma theory and simulation results are then briefly reviewed. NSA

**N73-33698#** Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

**INVESTIGATION OF UNIVERSAL PLASMA INSTABILITIES Annual Progress Report No. 8**

1 Jun. 1973 15 p refs

(Contract AT(40-1)-3405)

(ORO-3405-37; APR-8) Avail: NTIS HC $3.00

Summaries of work during this period are given for the following: (1) Parametric excitation of ion acoustic waves; (2) standing waves in a moving plasma medium; (3) anomalous plasma resistivity, turbulence in collisionless plasma, and nonresonant, RF, plasma heating, (4) asynchronous quenching effects in beam-plasma interactions; and (5) Lashinsky-Cap equation for convection phenomena. NSA

**N73-33699#** Cornell Univ., Ithaca, N.Y.

**PLASMA HEATING WITH A RELATIVISTIC ELECTRON BEAM**

P. Korn, F. Sandel, and C. Wharton 1972 5 p refs Presented at 6th European Conf. on Controlled Fusion and Plasma Phys., Moscow, 30 Jul. - 3 Aug. 1973

(Contract AT(11-1)-3165)

(COO-3165-4; Conf-730705-8) Avail: NTIS HC $3.00

Significant plasma heating due to the interaction of an intense relativistic electron beam with a plasma column was observed in a new experiment. The threshold for the onset of heating and the dependence of total perpendicular energy on beam current are similar to the cases for direct turbulent heating in the same plasma geometry. Author (NSA)

**N73-33700#** Oak Ridge National Lab., Tenn.

**ORMAK AND NEUTRAL INJECTION**

C. F. Barnett, L. A. Berry, C. E. Bush, J. D. Callen, J. F. Clarke, R. J. Colchin, R. A. Dory, A. C. England, J. T. Hogan, G. G. Kelley et al 1973 4 p refs Sponsored by AEC

(Conf-730705-3) Avail: NTIS HC $3.00

The plasma conditions attained in ohmically heated ORMAK experiment provide a satisfactory base for neutral injection heating. Plasma flows and radial electric fields of the same magnitude as those expected to result from neutral injection have been observed in ORMAK. They appear to have no deleterious effect on the plasma. Author (NSA)

**N73-33701#** European Space Research Inst., Frascati (Italy).

**EFFECT OF SOUND WAVES, ALFVEN WAVES AND HEAT FLOW ON INTERPLANETARY SHOCK WAVES**

J. F. McKenzie and M. Bornatici (Calabria Univ., Cosenza, Italy)
Aug. 1973 22 p refs Submitted for publication
Avail: NTIS HC $3.25

The effects of sound waves, Alfven waves and additional heat flow on shock waves were analyzed. For the special cases in which the waves make their greatest impact on the Rankine-Hugoniot relations, it was found that: (1) Alfven waves diminish the shock compression; and (2) sound waves either enhance or diminish the compression ratio according to whether the incident wave vector is parallel or antiparallel to the direction of flow through the shock. An additional heat flux may either enhance or diminish the compression ratio depending upon whether the heat flux behind the shock is greater or less than that ahead of it. The implications of these results for interplanetary shocks are discussed. Author (ESRO)

**N73-33702#** Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
**A LINEAR RF TURBULENT HEATING EXPERIMENT**
H. M. Skarsgard Jun. 1973 18 p refs
(LRP-64/73) Avail: NTIS HC $3.00

The feasibility of hot turbulent plasma production by a large RF current flow (I = 20 KA) parallel to a steady magnetic field is discussed. The respective roles of skin depth at high plasma densities, ion acoustic instability onset, and Landau damping on final ion and electron temperatures or plasma thermal content are detailed. A list of needed plasma diagnostics is given. Level of turbulence measurements by CO2 laser scattering is discussed with regard to the relationship between turbulence and the heating rate or conductivity. The physical parameters to be selected are detailed and compared to those of similar existing experiments. ESRO

**N73-33703#** Stanford Univ., Calif. Inst. for Plasma Research.
**COMPUTER SIMULATION OF ELECTROSTATIC INERTIAL CONFINEMENT Final Report**
C. Barnes Jun. 1973 43 p refs
(Contract F44620-71-C-0005; AF Proj. 9752)
(AD-763826; SU-IPR-527; AFOSR-73-1117TR) Avail: NTIS CSCL 20/9

The technique of numerical plasma simulation is here used to study the behavior of the electrostatic-inertial confinement device. Particle type simulation models calculate the time evolution of the plasma contained within a spherical chamber into which high energy ions are radially injected. Two types of steady state configurations were found to exist, one of which includes a virtual anode. Neither allows a particle density enhancement over that due to geometrical focussing. Author (GRA)

**N73-33704#** Texas Univ., Austin. Electronics Research Center.
**UTILIZATION OF DIGITAL SPECTRAL ANALYSIS TECHNIQUES IN THE STUDY OF PLASMA FLUCTUATION DATA**
Donald E. Smith and Edward J. Powers, Jr. 15 May 1973 157 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-765549; TR-147; AFOSR-73-1533TR) Avail: NTIS CSCL 20/9

A 7-channel, 1.5 MHz bandwidth, analog-digital data acquisition system has been developed to interface an experimental situation with a large-core-storage digital computer. This enables experimentally generated data to be used in conjunction with digitally implemented spectral analysis techniques. The purpose of this project is use these spectral analysis techniques in the study of plasma fluctuation data associated with instabilities and turbulence. This study is unique in that these spectral analysis techniques allow one to determine both the frequency omega and spatial wave-number k associated with several waves simultaneously present in the plasma. This ability to measure omega and k enables one to compute the phase velocity of each wave and thereby identify coherent oscillations buried in a noisy environment. One is also able to verify resonant frequency and wavenumber selection rules associated with nonlinear interactions of waves in the plasma. These same techniques allow one to compute the spectral indes associated with a turbulent power spectrum while simultaneously measuring k versus omega, the latter information being needed to compare theory and experimental data. This data acquisition and spectral analysis system has been used in the study of the evolution of drift-wave turbulence under various experimental conditions. Author (GRA)

# 26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

**N73-33705** Illinois Univ., Urbana.
**HIGH FIELD EMISSION AND CAPTURE OF ELECTRONS AND HOLES AT ZINC CENTERS IN SILICON Ph.D. Thesis**
John Maxwell Herman, III 1972 122 p
Avail: Univ. Microfilms Order No. 73-17238

The electrical properties of the double acceptor zinc center in silicon are investigated in the high electric field, transition region of reverse biased N+P and P+N junctions. The electric field dependences of the thermal emission and capture rates of holes at zinc centers are obtained using a differential bias voltage technique. The double acceptor nature of substitutional zinc in silicon with three charge states (0,-1,-2) is unequivocally demonstrated. The thermal emission of electrons from doubly ionized zinc centers is not measurable in either N+P or P+N zinc diffused diodes. The low field thermal activation energies of holes from neutral and singly ionized zinc centers are 316 and 617 meV respectively. The thermal emission rate of holes from neutral zinc centers exhibits a very large electric field dependence for fields of 1,000 to 10,000 v/cm, while that from singly ionized zinc centers is small. A second zinc-related center, which is attributed to the previously reported acceptor-like, zinc-boron complex, is studied. Dissert. Abstr.

**N73-33706** New York Univ., N.Y.
**CONTACTLESS, LOCAL FREE CARRIER PROPERTY CHARACTERIZATION IN SEMICONDUCTORS Ph.D. Thesis**
John Charles Herper 1973 119 p
Avail: Univ. Microfilms Order No. 73-19391

A new diagnostic technique simultaneously yields the excess free carrier lifetime and ambipolar diffusion coefficient as a function of depth in localized regions within a semiconductor. This transient optical method gives more physical insight into charge carrier dynamics in semiconductors than other procedures. Above band-edge light pulses are used to illuminate the surface of a semiconductor. Bursts of excess carriers generated near the surface diffuse into the bulk and decay by recombination. The space-time evolution of the carrier density at points within the bulk is measured by free carrier absorption of energy in a narrow laser beam. This below band-edge light propagates parallel to and is scanned normal to the injection surface. Dissert. Abstr.

**N73-33707** Vanderbilt Univ., Nashville, Tenn.
**AN INVESTIGATION OF ELECTRICAL SWITCHING PHENOMENA IN THE AMORPHOUS ARSENIC TELLURIDE ARSENIC SELENIDE SYSTEM Ph.D. Thesis**
Harry Roy Sanders 1972 75 p
Avail: Univ. Microfilms Order No. 73-14529

Extensive bulk switching studies have been performed on the xAs2Te3:(1-x)aS3Se3 system as a function of composition. Both threshold and memory switching have been observed in all samples. Breakdown voltage and switching stability have been found to increase with increasing Se content. Breakdown voltage was found to be essentially independent of sample thickness. Switching delay times at low overvoltage were in the hundreds of milliseconds range. An equation for breakdown voltage as a function of conductivity, activation energy and temperature was derived and was used to predict the magnitude of the room temperature breakdown voltage for all compositions studied. The results of breakdown voltage versus temperature measurements were computer fit to the equation, yielding experimental values of activation energy for conduction. The results clearly substantiate the thermal mechanisms for electrical switching behavior in bulk samples of these glasses. Dissert. Abstr.

**N73-33708** Cornell Univ., Ithaca, N.Y.
**SUPERSOLID AND LONG-RANGE ORDER Ph.D. Thesis**
Kao-Shien Liu 1973 111 p
Avail: Univ. Microfilms Order No. 73-18354

Two kinds of long range order, namely crystalline, or long range diagonal order, and off diagonal long range order (ODLRO), or Bose-Einstein condensation are dealt with. The simultaneous presence of ODLRO with crystalline order, and the existence of a vortex lattice in a Bose system are discussed. The possible existence of a supersolid phase displaying both crystalline order and ODLRO is studied by a model Hamiltonian and various classes of model states. The possible phase diagram of a quantum lattice gas model with particular reference to the existence of a supersolid was discussed within the framework of mean field theory. Dissert. Abstr.

**N73-33709** Case Western Reserve Univ., Cleveland, Ohio.
**HIGH PRESSURE AND THE MECHANICAL BEHAVIOR OF Cu-COMPOUNDS Ph.D. Thesis**
Gabriel Torres Villasenor 1972 307 p
Avail: Univ. Microfilms Order No. 73-16171

An experimental study was made of the plastic flow and fracture behavior of two brittle copper compounds, cuperous oxide and the gamma 2 phase of the Cu-Al system, at high pressure and at room temperature under uniaxial compression at constant strain. The principal objectives are to gain an understanding of the mechanisms controlling the incidence of fracture and plastic flow at room temperature in both materials, determine the role of stoichiometric composition and thermal treatment in the case of the intermetallic compound and to extend understanding of the influence of pressure on the mechanical behavior of solids per se. Plastic behavior was not affected by pressure, but fracture stress was continuously increased by the pressure. The crack nucleation mechanism based on dislocations, was found to be not accurate to explain the nucleation of cracks in Cu2O and the gamma-phase. The origin of fracture in these materials appear to be in the surface of the specimen. Dissert. Abstr.

**N73-33710** State Univ. of New York, Buffalo.
**MACROSCOPIC QUANTUM EFFECTS IN SUPERCONDUCTING RINGS CONTAINING TWO JOSEPHSON JUNCTIONS Ph.D. Thesis**
John Gilbert Wilson 1973 155 p
Avail: Univ. Microfilms Order No. 73-19255

An experimental investigation was made of the behavior of a macroscopic quantum interferometer. The quantum interferometers studied consisted of an evaporated tin ring containing two Josephson tunneling junctions symmetrically located in the ring which was cooled to 1.2 K so that the tin was superconducting. Substantial improvements were made over past quantum interferometers in four areas: (1) ring dimensions, (2) construction of rings such that applied magnetic field would enter the ring and Josephson junctions, (3) suitability of Josephson tunneling junctions used in the rings from standpoint of exhibiting behavior predicted by Josephson equations, and (4) techniques that allow one to trap the ring in a pre-selected quantum state and study its dynamic behavior in the presence of magnetic field changes. A discussion of the junction preparation techniques and the static and dynamic theories of junctions in a ring are presented. The results show direct experimental confirmation of the quantization of the fluxoid in a ring with two Josephson junctions. Dissert. Abstr.

**N73-33711** Illinois Univ., Urbana.
**PREPARATION AND PROPERTIES OF INDIUM GALLIUM PHOSPHIDE Ph.D. Thesis**
Harry Michael Macksey 1972 124 p
Avail: Univ. Microfilms Order No. 73-17307

A number of the properties of the ternary III-V semiconductor In (1-x)Ga(x)P were studied with the major emphasis on radiative recombination processes. The ultimate practical goal is the development of highly efficient LED's emitting near the peak of the human eye response at 5550 A. The basic principles of radiative recombination in semiconductors and the practicalities of crystal growth are considered to explain the advantages and disadvantages of various semiconductor crystals being studied for use as LED's. State-of-the-art device parameters are discussed and used to show that In(1-x)Ga(x)P, though only now receiving attention, offers much promise. Dissert. Abstr.

**N73-33712** Illinois Univ., Urbana.
**ELECTRON THERMAL CONDUCTIVITY OF THIN FILMS OF STRONG-COUPLING SUPERCONDUCTORS AND OF SUPERCONDUCTORS CONTAINING RARE EARTH IMPURITIES Ph.D. Thesis**
Bernard Joseph Mrstik 1973 144 p
Avail: Univ. Microfilms Order No. 73-17607

The thermal conductivity is given of several superconducting films. These films were evaporated onto substrates held at liquid helium temperatures, and therefore the phonon mean free path in these films was very short. Consequently, the phonons contributed very little to the thermal conductivity. The experimentally determined thermal conductivity was therefore due almost entirely to the conduction of heat by the electrons. The electron thermal conductivity of a strong-coupling superconductor and of superconductors containing rare earth impurities are also measured this way. Results are in good agreement with experimental measurements on a quench-condensed film of lead. The low temperature deviations are related to the properties of the substrate, rather than to the characteristics of the superconducting films. Dissert. Abstr.

**N73-33713** California Univ., San Diego.
**MEASUREMENTS ON LIQUID He3 BELOW 5 m K Ph.D. Thesis**
David Lewis Stolfa 1973 177 p
Avail: Univ. Microfilms Order No. 73-18855

A refrigerator using the principle of adiabatic nuclear demagnetization of copper is used to cool liquid He-3 to less than 2 m K. A technique of thermometry using non-resonant nuclear magnetic susceptibility of metals is developed. Such a technique holds the promise of lower power dissipation and hence better thermal equilibrium between thermometer and experiment than do other methods of thermometry. The properties of He 3 are investigated to identify any anomalies that may be attributed to the newly found correlated state near 2 m K in liquid He-3 by the Corneli group. The non-resonant static susceptibility of He-3 is measured at 0.5 atmospheres with no observable change in susceptibility that can be ascribed to the He-3. The low pressure data gives no indication of abnormal behavior but at high pressure there clearly appears to be a peak excess heat capacity at 2.1 m K. Dissert. Abstr.

**N73-33714** Cornell Univ., Ithaca, N.Y.
**PRESSURE-INDUCED ELASTICITY CHANGES IN VANADIUM SILICIDE Ph.D. Thesis**
Ronald Ernulf Larsen 1973 111 p
Avail: Univ. Microfilms Order No. 73-18348

The single-crystal elastic moduli of V3Si were measured for hydrostatic pressures to 2.5 kb and temperatures from 13.5 to 296 K to determine the influence of volume decreases on the anomalous C' shear mode softening in this A-15 material. Moduli values were obtained by measuring the cw resonance frequencies of three thin specimens that did not undergo at room pressure the well-known structural transformation exhibited by some V3Si crystals near 20 K. Theory for the transmission version of the resonance method as applied to thin specimens is developed, and the entire apparatus is described. The measurements show all moduli to be linear in pressure. These results are compared with those obtained earlier for large C'-type shear loads. The possibility of inducing a structural transformation with hydrostatic pressure is discussed. Dissert. Abstr.

**N73-33715** Virginia Univ., Charlottesville.
**STUDIES ON VACANCY BEHAVIOR IN METALS Ph.D. Thesis**
William Jacob Tropf, III 1973 182 p
Avail: Univ. Microfilms Order No. 73-18982

The interaction of supersaturated vacancies and vacancy clusters with dislocations was studied in copper single crystals deformed at low strain. The crystals were prepared by zonemelting at a high ambient temperature, in vacuo, in a specially constructed furnace, and slow cooled to a much lower temperature over a long period of time. The cooling was programmed in such a manner as to allow vacancies to migrate to the free surface of

the crystal without forming a high supersaturation of vacancies in the interior. Crystals grown in such a manner had a low dislocation density, were free of subboundaries, and had a low yield stress. A theoretical cooling treatment, designed to remove soluble constituents to suitable sinks was developed, and the fastest cooling rate for the elimination of soluble constituents was devised. Dissert. Abstr.

**N73-33716** State Univ. of New York, Buffalo.
**STUDY OF CYCLOTRON RESONANCE LINEWIDTH IN SEMICONDUCTORS Ph.D. Thesis**
Chintalapati Sitarama Raju 1973 75 p
Avail: Univ. Microfilms Order No. 73-19229

The cyclotron resonance linewidth and the energy shift are shown to satisfy a nonlinear integral equation. This equation is solved in the weak coupling limit for electron-impurity and electron-phonon systems, with the consideration of inelastic scattering by phonons in the latter. In the case of an electron-impurity system with a short range force between the electron and the impurity (scatterer), the question of how the cyclotron resonance linewidth compares in numerical value with the collision frequency, is investigated. The cyclotron resonance linewidth of optical polarons (electrons coupled to optical phonons) with particular reference to indium antimonide (InSb) is also studied. The relation between the linewidth and the life-time of the electronic eigenstate is discussed. The frequency and the temperature dependence of the linewidth is calculated and compared with the available experimental data in InSb.
Dissert. Abstr.

**N73-33717** Illinois Univ., Urbana.
**THE TEMPERATURE DEPENDENCE OF SECOND-ORDER ELASTIC CONSTANTS IN CUBIC MATERIALS Ph.D. Thesis**
Joseph Allen Garber 1972 141 p
Avail: Univ. Microfilms Order No. 73-17214

The temperature dependence of the second-order elastic constants of cubic crystalline materials was derived on the basis of a quasi-harmonic anisotropic continuum model. It is assumed that the strain dependence of the frequencies of oscillation in a given material is independent of wavelength. The results are expressed in terms of the properties of the static lattice on the assumption that higher than first order effects in the (vibrational) strain for the actual lattice can be neglected. The temperature dependent part of the adiabatic second-order elastic constants was found not proportional to the vibrational energy. The Einstein, Debye, and isotropic continuum models are also briefly considered. Mathematical expressions in terms of the second-, third-, and fourth-order elastic constants are given for three temperature regions. Comparison between theory and experiment is also made for several alkali halides, beta-brass, copper, silver, and gold.
Dissert. Abstr.

**N73-33718** Illinois Univ., Urbana.
**PROPERTIES OF SILICON-SILICON DIOXIDE INTERFACE STATES IN THIN OXIDE MOS STRUCTURES Ph.D. Thesis**
Dennis Hammond Eaton 1972 184 p
Avail: Univ. Microfilms Order No. 73-17191

The properties of silicon-silicon dioxide interface states were investigated using metal oxide semiconductor capacitors with very thin (> 500 A) oxides. Devices were fabricated on nondegenerate p-type silicon having (111) orientation. The interface state density in the lower half of the silicon bandgap was measured using both the low and high frequency capacitance techniques for devices with oxide thicknesses from 63 to 445 A. The density of interface states exhibits a pronounced peak at about 0.3-0.4 eV above the valence band edge. The interface state density increases with oxide thickness up to a thickness about 200 A and is relatively independent of oxide thickness for thicker oxides. Annealing in argon at the oxidation temperature causes only a very slight reduction in interface state density. The frequency dependence of the impedance of the interface states was studied using devices with an oxide thickness of 83 A. Dissert. Abstr.

**N73-33719** Illinois Univ., Urbana.
**THERMAL BOUNDARY RESISTANCE Ph.D. Thesis**
Ronald Edward Peterson 1973 149 p
Avail: Univ. Microfilms Order No. 73-17622

The acoustic mismatch theory for the thermal boundary (Kapitza) resistance has been modified so as to include the effect of phonon attenuation near the interface. The modified theory is in good agreement below 0.2 K with present measurements on metal-dielectric interfaces and with previous measurements at liquid He-solid interfaces. The influence of the electron-phonon interaction on the thermal boundary resistance was studied experimentally, both as a phonon attenuating mechanism which may lower the boundary resistance and as an additional thermal resistance which appears between the electrons and phonons in thin metal foils. Dissert. Abstr.

**N73-33720** Illinois Univ., Urbana.
**THIRD SOUND IN THIN HELIUM FILMS Ph.D. Thesis**
Bharati Asoka Ratnam 1972 112 p
Avail: Univ. Microfilms Order No. 73-17379

The superflow properties are given of two-dimensional superfluid helium. The velocity and attenuation of third sound are measured in thin superfluid He4 and He3-He4 films. In third sound resonance cells a unique thermodynamic state of thin helium films have been obtained which allow precise measurements of the third sound velocity and attenuation. Third sound resonances indicate a cutoff for the propagation of third sound in thin helium films at finite values of the average superfluid density in the film. This cutoff is accompanied by an exponential rise in the dc thermal resistance of the helium film which indicates the formation of high energy excitations of 0.08 eV. Addition of He3 to He4 film produces several dramatic changes in the propagation of third sound. Dissert. Abstr.

**N73-33721#** Chalmers Univ. of Technology, Goteborg (Sweden).
**TEMPERATURE DEPENDENCE OF SPIN-HAMILTONIAN PARAMETERS FOR CHROMIUM DOPED RUTILE**
P. O. Andersson, A. Jelenski, and A. Lundin Nov. 1972 24 p refs
(RR-110) Avail: NTIS HC $3.25

The temperature dependence of the spin-Hamiltonian parameters for substitutional Cr (3+) ions in single crystal rutile ($TiO_2$) was studied. The measurements were performed at about 9.2 GHz and 35 GHz on a fine powder of single crystalline Cr-$TiO_2$ for three temperatures, 95 K, 200 K, and 295 K. It was found that the spin-Hamiltonian parameter D diminishes with descreasing temperature in the temperature interval studied. The behavior of g and E is more complex. A tentative extrapolation of the data towards 0 K was made. Author

**N73-33722*#** Radio Corp. of America, Princeton, N.J.
**ADVANCED INVESTIGATION OF TWO-PHASE CHARGE-COUPLED DEVICES Final Report**
W. F. Kosonocky and J. E. Carnes May 1973 77 p refs
(Contract NAS1-11861)
(NASA-CR-132304; PRRL-73-CR-27) Avail: NTIS HC $6.00 CSCL 20L

The performance of experimental two phase, charge-coupled shift registers constructed using polysilicon gates overlapped by aluminum gates was studied. Shift registers with 64, 128, and 500 stages were built and operated. Devices were operated at the maximum clock frequency of 20 MHz. Loss per transfer of less than .0001 was demonstrated for fat zero operation. The effect upon transfer efficiency of various structural and materials parameters was investigated including substrate orientation, resistivity, and conductivity type; channel width and channel length; and method of channel confinement. Operation of the devices with and without fat zero was studied as well as operation in the complete charge transfer mode and the bias charge, or bucket brigade mode. Author

**N73-33723#** Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
**DEFECTS IN METAL CRYSTALS Annual Progress Report, 1 May 1972 - 30 Apr. 1973**
R. W. Balluffi and D. N. Seidman Jan. 1973 39 p refs
(Contract AT(11-1)-3158)
(COO-3158-17) Avail: NTIS HC $4.00

A broad investigation was made of the basic properties of

crystal defects in metals. Attention was focused on point defects (vacancies, interstitials, and solute atoms), line defects (dislocations), and planar defects (dislocation arrays, grain boundaries and surfaces). Data are reported on the following: (1) vacancy defects in quenched platinum by field ion microscopy (FIM) and electric resistivity, (2) FIM and electric-resistivity study of vacancy defects in tungsten gamma irradiated with W ions or electrons, (3) FIM studies of defects in platimum irradiated with Pt ions or electrons, (4) FIM of gold and in-situ studies of gold irradiated with gold or argon ions, (5) computer simulation of contrast effects produced by defects in FIM specimens, (6) interpretation of ledge bright spot contrast effects in FIM images, (7) possibility of an equilibrium array of voids in a material subject to irradiation, (8) FIM studies of solute atoms in dilute platimum alloys, (9) structures of low and high angle grain boundaries, (10) direct measurements of the range of a focused-collision replacement sequence in gold, (11) automatization of FIM data processing, and (12) the atom-probe FIM. Author (NSA)

**N73-33724#** Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
**INFLUENCE OF RADIATION DAMAGE ON THE PROPERTIES OF A SUPERCONDUCTOR**
M. Soell Oct. 1972 65 p refs In GERMAN; ENGLISH summary
(IPP-4/104) Avail: AEC Depository Libraries HC $5.25

After discussing problems of irradiation effects in solids, a review is given of the influence of radiation damage to the properties of type 2 superconductors. The damages in the critical temperature T sub c in the critical magnetic fields and in the critical current I sub c are treated. The critical temperature T sub c was reduced in all superconductors by particle irradiation. Clean type 2 superconductors such as Nb show an increase of the H sub c squares and the critical current, whereas by cold-worked NbZr and NbTi a decrease of I sub c was measured. This decrease is explained by the reduction of the pinning strength of the dislocation wall. The behavior of the critical current of Nb3Sn by irradiation depends on the value before the irradiation. For samples with initial low J sub c values, the critical current was increased by particle irradiation, whereas for samples with high J sub c the opposite was measured. Author (NSA)

**N73-33725#** Rutherford High Energy Lab., Chilton (England). Dept. of Engineering Science.
**INDIRECT COOLING OF A SUPERCONDUCTING MAGNET USING SUPERCRITICAL HELIUM**
R. L. Bailey, B. Colyer, and G. J. Homer Dec. 1972 34 p
(RHEL/R-258) Avail: AEC Depository Libraries HC $3.75; HMSO 40p; PHI $1.85

A dc superconducting quadrupole magnet was cooled to 4.36 K. A low temperature bath was situated several feet away from the magnet, and the two were connected by a closed system circulating supercritical helium as a heat exchange medium. At temperatures below about 6 K two phase helium was circulated in preference to supercritical helium. The magnet was energized up to its quench current several times and the cooling system dealt safely and efficiently with resulting releases of energy. The magnet current reached 92% of the short sample value at 4.4 K. A system of this type is considered suitable for cooling dc beam line elements. Author (NSA)

**N73-33726#** Washington Univ., Seattle. Coll. of Engineering.
**STUDY OF PHASE TRANSFORMATIONS AND SUPERCONDUCTIVITY Annual Progress Report**
D. H. Polonis 15 Oct. 1972 58 p refs
(Contract AT(45-1)-2225)
(RLO-2225-T-13-14) Avail: NTIS

The investigation of transformation processes in beta stabilized titanium and zirconium alloys has revealed the following results: (1) Fine precipitates that do not lead to diffraction effects have been detected in quenched TiCr alloys quenched to retain 100% beta phase. (2) During the initial stages of aging, the fine precipitates tend to grow and produce strain in the beta matrix prior to the detection of the omega phase. (3) A phase separation reaction can enhance or retard the nucleation of the omega phase, depending on the temperature at which the phase separation is induced. (4) When the omega phase is reprecipitated after step quenching or a reversion treatment, it nucleates randomly in the enriched beta matrix without any apparent association with the solute lean zones, (5) The nucleation of the alpha phase occurs preferentially at the interface between solute lean and solute rich regions. Superconducting transition measurements performed on several series of quenched titanium ternary alloys have verified that there is a dependency of Tc on the electron-atom concentration. Author (NSA)

**N73-33727#** Yale Univ., New Haven, Conn.
**STUDY OF IDEAL MAGNETIC CRYSTALS Final Report, 1 Jun. 1963 - 31 May 1973**
W. P. Wolf 1973 23 p
(Contract AT(11-1)-3574)
(COO-3574-95) Avail: NTIS HC $3.25

A series of related experimental and theoretical research projects were designed to obtain detailed quantitative understanding of the thermal and magnetic properties of a number of relatively simple magnetic materials. These have included RCl3 (with R = Ce, Gd, La: Gd and Eu: Gd), CeBr3, R(C2H5SO4)3 9H2O (with R = Ce and Dy), R(OH)3 (with R = La, Nd, Eu, Gd, Tb, Dy, Ho, Er and Er: Tb), Dy3Al5O12 (DAG), Yb3Ga5O12 and Na3(Ce(C7H3NO4)3).5H2O (CDP). Little or no data are included here, but an extensive listing of work published during the contract is included. Author (NSA)

**N73-33728#** Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
**MOTION OF IONS IN SOLID HELIUM Progress Report, 1 May 1971 - 31 Jan. 1973**
1973 56 p refs
(Contract AT(11-1)-2027)
(COO-2027-6) Avail: NTIS

Details of results obtained on six experiments and the redesign of another are given in addition to the completion of a He-3/He-4 dilution refrigerator. Each of the experiments is related to the understanding of ions and like entities in liquid and solid He and to the study of excitations in solid helium. These experiments are: (1) measurement of mobilities of charge carriers in solid He, (2) vacancy relaxation times in solid He, (3) electron spin resonance in liquid He, (4) electron tunneling from the bubble state in liquid He in presence of strong electric fields, (5) lifetime measurements of orthopositronium in liquid and solid He, (6) search for Lyman-alpha radiation from positronium, and (7) extraction of charged droplets from the surface of liquid helium. In the course of one of these experiments, electron spin resonance, an alternate technique to Mott scattering was developed for study of electron spin polarization (ESP) in ferromagnetic materials. It is a new method for measuring the sign and relative magnitude, and possibly the absolute magnitude of ESP. Each experiment is discussed separately. Author (NSA)

**N73-33729#** Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
**PREPARATION AND STUDY OF RARE EARTH DOPED GALLIUM PHOSPHIDES Final Report [PREPARATION ET ETUDE DU PHOSPHURE DE GALLIUM DOPE AUX TERRES RARES. RAPPORT FINAL]**
M. Moulin and N. Sol 7 Apr. 1972 42 p ref In FRENCH
(Contract DRME-70/339)
Avail: NTIS HC $4.25

Rare earth doped gallium phosphide preparation methods are presented for enhanced emission induced by 4 F band transitions of a rare earth substituted on the Ga sites of a GaP monocrystal. The epitaxy synthesis method for which procedures are given proved unsuccessful due to unknown phase diagram. A seedless free monocrystal growth in argon method was used successfully. Relevant procedures are given. The optical characterization of the layers by metallography, absorption spectra, and cathodoluminescence is discussed. Physicochemical properties of the crystals were investigated using electron and ion probes, and emission spectrography. Results are shown in graphical form and the sensitivity of the various analysis methods is discussed. ESRO

**N73-33730#** University of Southern Calif., Los Angeles. Electronic Sciences Lab.
**IR WINDOW STUDIES Quarterly Technical Report**
F. A. Kroger and John H. Marburger 15 Dec. 1972 70 p

refs
(Contract F19628-72-C-0275; ARPA Order 2055)
(AD-764904; USCEE-443; AFCRL-TR-73-0054; QTR-2) Avail: NTIS CSCL 20/5

Advances were made in the theory of multiple phonon absorption mechanisms, the theory of thermal skewing of asymmetric beams, and in the experimental characterization of IR window materials. Preliminary calorimetric measurements of the absorption coefficient in melt grown chromium-free GaAs versus wavelength yield values lower than any previously measured in chromium doped samples. The results of measurements of the mechanical properties of GaAs, and data related to the defect chemistry of CdTe and CdS are also reported. Systems for the production of ultra pure alkali halide and III-V compounds are nearing completion. Author (GRA)

**N73-33731#** Westinghouse Research Labs., Pittsburgh, Pa.
**INVESTIGATION OF FLUX PINNING AND CRITICAL CURRENT DENSITIES IN TYPE 2 SUPERCONDUCTORS Technical Report, 1 Jul. 1972 - 30 Jun. 1973**
Daniel W. Deis, Mahendra P. Mathur, Martin Ashkin, and Clifford K. Jones 15 Aug. 1973 31 p refs
(Contract N00014-73-C-0026; NR Proj. 039-116)
(AD-765368; TR-1) Avail: NTIS CSCL 20/3

Magnetization and magnetic torque measurements were performed on oriented single crystal specimens of Nb and Mo-Re alloys. The results were analyzed in terms of the flux pinning characteristics of these specimens. Similar measurements were made on Nb-Cu and (Nb-Ti)-Cu composite conductors and used to determine their critical current densities. The latter results compared quite favorably with direct transport current measurements. Author (GRA)

**N73-33732#** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**NONCRYSTALLINE SEMICONDUCTORS: ELECTRICAL AND THERMAL PROCESSES Semiannual Technical Report**
Lyle H. Slack 1 Aug. 1973 34 p refs
(Contract DA-ARO(D)-31-124-72-G72; ARPA Order 1562)
(AD-765346) Avail: NTIS CSCL 20/1

Characterization of the switching processes in selected amorphous semiconductors continues to be the focus of this work. The work is progressing in two related channels, the first comparing the actual switching behavior of amorphous semiconductor films with computer simulations based on an assumed thermal model, and the second correlating the observed electronic spectra of crystalline and amorphous semiconductors with their electrical characteristics. GRA

**N73-33733#** Stanford Univ., Calif. High Energy Physics Lab.
**EVIDENCE FOR SURFACE-STATE-ENHANCED FIELD EMISSION IN RF SUPERCONDUCTING CAVITIES**
H. A. Schwettman, J. P. Turneaure, and R. F. Waites Feb. 1973 45 p refs Sponsored in part by NSF
(Contract N00014-67-A-0112-0076)
(AD-765336; HEPL-699) Avail: NTIS CSCL 20/3

Measurements of the X-radiation and the electron loading in a niobium cavity resonant in the TM(010) mode at 1208 MHz have been made in order to study enhanced electron field emission in superconducting cavities. Measurements have also been made of the low temperature dc electron field emission from bismuth, niobium, copper and tungsten using a configuration which approximates the point-to-plane geometry. In the rf cavity measurements, it is found that the X-radiation count rate data follows a modified Fowler-Nordheim equation which takes into account the time dependent rf fields, the electron dynamics in the rf fields, the emission of secondary electrons, and the production and absorption of X-radiation. Further, it is found that the X-radiation from the cavity can be reduced by a factor of 10,000 to 1,000,000 by helium-ion sputter processing at low temperature. (Modified author abstract) GRA

**N73-33734#** Army Foreign Science and Technology Center, Charlottesville, Va.
**POSSIBILITY OF USING TRIPLE SEMICONDUCTOR COMPOUNDS IN THERMOELECTRIC AND PHOTOELECTRIC CONVERTERS**
L. I. Berger 27 Nov. 1972 7 p refs Transl. into ENGLISH from Metody Polucheniya Khim reaktivov i Preparatov (USSR), no. 32, 1970 p 315-320
(AD-765730; FSTC-HT-23-346-73) Avail: NTIS CSCL 20/12

Typical physico-chemical properties of the triple tetrahedral semiconductor compounds studied, relative cheapness and availability of components of most of these substances as compared to, in particular, germanium and high-purity silicon, and weak dependence of thermoelectric parameters of compounds on deviations in their composition, from the stechiometric composition help in drawing the conclusion regarding bright practical prospects of these substances as a material for solar thermoelectric generators. GRA

# 27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

**N73-33735*#** California Inst. of Tech., Pasadena. Daniel and Florence Guggenheim Jet Propulsion Center.
**SOME EXPERIMENTS RELATED TO L-STAR INSTABILITY IN ROCKET MOTORS**
R. N. Kumar and R. P. McNamara Mar. 1973 111 p refs Prepared for JPL
(Contract NAS7-100)
(NASA-CR-135766) Avail: NTIS HC $7.75 CSCL 21I

The role of solid phase heterogeneity on the low-pressure L-star instability of nonmetallized AP/PBAN propellants is explored. Four particle size distributions are employed in propellants that are otherwise identical. Over one hundred test firings were conducted in the 21/2 in. diameter L-star burner. Pressure time histories in the chamber and color movies of two firings constitute the raw data. An economical firing program was used which enables the interesting range of L-star values to be covered during a single firing (at a set mean pressure), through the variations in the depleting propellant volume. Time-independent combustion, Helmholtz mode, chuff mode, and the pressure-burst phenomena are revealed as the principal signatures. Of these, the Helmholtz mode is found to be the most ordered form of instability. Author

**N73-33736#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**INFLUENCE OF METAL ADMIXTURES ON THE SPECIFIC IMPULSE OF ROCKET FUELS**
P. F. Pokhil, A. F. Beliaev, Iu. V. Frolov, V. S. Logachev, and A. I. Korotkov [1973] 7 p refs Transl. into ENGLISH of the book "Gorenie Poroshkoobraznykh Metallov v Acktivnykh Sredakh" Moscow, Nauka, 1972 p 230-238
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The influence of metal admixtures on the specific impulse of solid rocket propellants is discussed. It is stated that the efficiency of using aluminum in place of an oxidizer is seven to eight units higher in specific impulse that in place of the nitrided fuel. Metallic admixtures can be introduced into solid propellant mixtures composites both because of the polymer fuel and the oxidizer. Tables of data are included to show the energy properties of fuels for solid rocket propellant mixtures and the characteristics of fuel-oxidizer mixtures. Graphs of the changes in specific impulse for various quantities of metal added to the propellant are developed. Author

**N73-33737*#** McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
**STUDY OF THERMODYNAMIC VENT AND SCREEN BAFFLE INTEGRATION FOR ORBITAL STORAGE AND TRANSFER OF LIQUID HYDROGEN Final Report, 1 Jul. 1972 - 31 Jul. 1973**
E. C. Cady Aug. 1973 213 p refs
(Contract NAS3-15846)
(NASA-CR-134482; MDC-G4798) Avail: NTIS HC $12.75 CSCL 22B

A comprehensive analytical and experimental program was

performed to determine the feasibility of integrating an internal thermodynamic vent system and a full wall-screen liner for the orbital storage and transfer of liquid hydrogen (LH2). Ten screens were selected from a comprehensive screen survey. The experimental study determined the screen bubble point, flow-through pressure loss, and pressure loss along rectangular channels lined with screen on one side, for the 10 screens using LH2 saturated at 34.5 N/cm2 (50 psia). The correlated experimental data were used in an analysis to determine the optimum system characteristics in terms of minimum weight for 6 tanks ranging from 141.6 m3 (5,000 ft3) to 1.416 m3 (50 ft3) for orbital storage times of 30 and 300 days. Author

**N73-33738#** Atomic Energy Commission, Washington, D.C.
**HYDROGEN AND OTHER SYNTHETIC FUELS: A SUMMARY OF THE WORK OF THE SYNTHETIC FUELS PANEL**
Sep. 1972 135 p refs
(TID-26136) Avail: NTIS MF $1.45; SOD HC $2.25

The development of hydrogen as a synthetic fuel is attractive because it is essentially clean burning, the main combustion product being water; it may be substituted for nearly all fuel uses; it can be produced from domestic resources; it is available from a renewable and universal raw material-water; and nearly all primary energy sources, nuclear, solar, etc., may be used in its production. The main obstacles to the use of hydrogen as a universal fuel are its high cost relative to the current low prices for fossil fuels and, for some applications, the unresolved problems of handling a low-density or a cryogenic fluid. Safety considerations are discussed. The various options for the production of hydrogen, namely, electrolysis, thermochemical, biological, radiolytic, and various combinations, and the production of other synthetic fuels, particularly those made from hydrogen are discussed. Other synthetic fuels considered include ammonia (NH3), hydrazine (N2H4), methanol (CH3OH), methane (CH4), ethanol (C2H5OH), and gasoline (C8H18). NSA

**N73-33739#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
**DECOMPOSITION OF AMMONIUM PERCHLORATE IN THE CONDENSED PHASE Ph.D. Thesis - Tech. Univ. Munich**
Horst Selzer 9 Mar. 1973 122 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-59) Avail: NTIS HC $8.25; DFVLR, Porz, West Ger. 21,50 DM

A reaction model of ammonium perchlorate decomposition in the condensed phase was established by making use of results of certain experiments. These experiments were: electron emission measurements during decomposition of solid ammonium perchlorate (AP), infrared absorption analysis of heated AP, and structural analysis of the AP surface by a scanning electron microscope. The strong influence of adsorbed perchloric acid is indicated. ESRO

**N73-33740#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**AN ELECTRICAL FIELD IN THE RESERVOIR OF A FUEL TANK AS IT IS FILLED WITH ELECTRIFIED FUEL**
B. K. Maksimov, A. A. Obukh, A. A. Navatskii, and V. A. Mokryshev 27 Jul. 1973 11 p refs Transl. into ENGLISH from the book "Tekh. Vysokikh Napryazh." USSR, 1972 p 138-142
(AD-764941; FTD-HT-23-793-73) Avail: NTIS CSCL 21/4

Aviation fuel (kerosene, gasoline) is highly electrified during passage along pipes and through filters. Charged fluid, filling a reservoir, is a source of an electrical field in a vapor-air space. If the magnitude of the field reaches disruptive strength, a spark discharge will occur. The discharge can be the cause of the ignition of the fuel. The article shows the calculated and graphic dependences, which make it possible to quickly evaluate the components of a three-dimensional electrical field in a vapor-air space an example of which is the TZ-16 fuel tank. The illustrated results may be used for any other reservoir configuration which does not differ significantly from rectangular. GRA

**N73-33750** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Reaktionskinetik.
**DETERMINATION OF PHYSICO-CHEMICAL PROPERTIES OF UNCONVENTIONAL PROPELLANTS [BESTIMMUNG DER PHYSIKALISCH-CHEMISCHEN EIGENSCHAFTEN VON NICHTKONVENTIONELLEN TREIBSTOFFEN]**
F. Bachmaier *In* DGLR New Results in High-Energy Rocket Eng. Res. and Develop. Jul. 1972 p 7-20 In GERMAN (For availability see N73-33749 24-28)

# 28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

**N73-33741*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**HIGHLY NOISE SUPPRESSED BYPASS 6 ENGINE FOR STOL APPLICATION**
W. L. Jones, L. J. Heidelberg, and R. G. Goldman 1973 21 p refs Presented at Aeroacoustic Specialists Conf., Seattle, 15-17 Oct. 1973; sponsored by AIAA
(NASA-TM-X-71448) Avail: NTIS HC $3.25 CSCL 21E

A TF-34 engine with an acoustically treated ground test nacelle was built and tested to determine the feasibility of suppressing fan and core engine noise to the stringent levels required for STOL or short-haul commercial aircraft. The design incorporates wall treatment for the fan and core plus three treated splitter rings in the inlet and two treated splitters in the aft fan duct. Maximum suppression of fan tone noise of 40-45 db was obtained from both the inlet and aft fan treatment. At rated fan speed, overall noise was reduced by 21 PNdb to a value of 94 PNdb on a 500-foot sideline. The overall noise reduction value was limited by the jet noise floor. Thrust losses due to the acoustic treatment are also discussed. Author

**N73-33742*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**NOZZLE GEOMETRY AND FORWARD VELOCITY EFFECTS ON NOISE FOR CTOL ENGINE-OVER-THE-WING CONCEPT**
U. VonGlahn, J. Goodykoontz, and J. Wagner 1973 30 p refs Presented at 86th Meeting of the Acoustical Soc. of Am., Los Angeles, 30 Oct. - 2 Nov. 1973
(NASA-TM-X-71453; E-7730) Avail: NTIS HC $3.50 CSCL 21E

Acoustic shielding benefits for jet noise of engine-over-the-wing for conventional aircraft (CTOL) application were studied with and without forward velocity for various small-scale nozzles. These latter included convergent, bypass and mixer, with and without forward ejector, nozzles. A 13-inch free jet was used to provide forward velocity. Farfield noise data were obtained for subsonic jet velocities from 650 to 980 ft/sec and forward velocities from zero to 360 ft/sec. The studies showed that although shielding benefits were obtained with all nozzles, the greatest benefits were obtained with mixer nozzles. The absolute magnitude of the jet noise shielding benefits with forward velocity was similar to the variation in nozzle-only noise with forward velocity. Author

**N73-33743*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**DISPERSION AND DILUTION OF JET AIRCRAFT EXHAUST AT HIGH-ALTITUDE FLIGHT CONDITIONS**
James D. Holdeman [1973] 10 p refs Proposed for presentation at the 12th Aerospace Sci. Meeting, Wash., D. C., 30 Jan. - 1 Feb. 1974; sponsored by AIAA
(NASA-TM-X-71451; E-7720) Avail: NTIS HC $3.00 CSCL 21E

A method is presented for estimating the dispersion and dilution of jet aircraft exhaust from aircraft passage through times on the order of weeks thereafter. In the near wake of the aircraft, the solution is that for round turbulent jets in a parallel flow. More rapid dispersion due to atmospheric effects begins when the scale-dependent eddy viscosity becomes larger than the

turbulent jet eddy viscosity. In the far wake region, the solution approaches that for scale-dependent dispersion from a point source moving with the aircraft. Calculations are presented for supersonic aircraft at high altitude flight conditions. Author

**N73-33744*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**NUMERICAL SIMULATION OF NOISE PROPAGATION IN JET ENGINE DUCTS**
Kenneth J. Baumeister and Edward C. Bittner Washington Oct. 1973 50 p refs
(NASA-TN-D-7339; E-7217) Avail: NTIS HC $3.00 CSCL 20A

A finite difference formulation is presented which is useful in the study of acoustically treated inlet and exhaust ducts used in turbofan engines. The difference formulation can readily handle acoustic flow field complications, such as axial variations in wall impedance and cross-sectional area, that would occur in a sonic inlet. In formulating the difference solutions, the continuous acoustic field is lumped into a series of grid points spread uniformly throughout the field. At each point, the pressure is separated into its real and imaginary terms. Example solutions are presented for sound propagation in a one-dimensional straight hard-wall duct and in a two-dimensional straight soft-wall duct without steady flow. Author

**N73-33745#** Joint Publications Research Service, Arlington, Va.
**THE BASIC PROBLEMS OF LIQUID-FUELED ROCKET ENGINES**
V. P. Glushko 5 Oct. 1973 11 p Transl. into ENGLISH from Aviat Kosmonavt. (Moscow), no. 6, 1973 p 32-33, 42-43
(JPRS-60208) Avail: NTIS HC $3.00 CSCL 21H

A discussion is presented of the scientific and technical problems involved in developing liquid-fueled rocket engines. Author

**N73-33746#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**SOLID PROPELLANT ROCKET MOTORS**
V. A. Volodin [1973] 23 p Transl. into ENGLISH from the book "Konstruktsiia i Proektirovanie Raketnykh Dvigatelei" Moscow, Mashinostr., 1971 p 282-308
Avail: NTIS HC $3.25; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The design characteristics of solid propellant rocket engines (SPRE) are discussed in terms of the disposition of the embedded, and case-bonded propellant charges, and nozzle arrangement in the housing. The constraints, propellant composition and properties are described, and a comparison of the characteristics of SPRE and liquid rocket engines is presented. F.O.S.

**N73-33747*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**AN EXPERIMENTAL INVESTIGATION OF TWO-PHASE LIQUID OXYGEN PUMPING**
Loren A. Gross Washington Nov. 1973 26 p refs
(NASA-TN-D-7451; M-383) Avail: NTIS HC $3.00 CSCL 21I

The results of an experimental program to explore the feasibility of pumping two-phase oxygen (liquid and gas) at the pump inlet are reported. Twenty-one cavitation tests were run on a standard J-2 oxygen pump at the MSFC Components Test Laboratory. All tests were run with liquid oxygen 5 to 10 K above the normal boiling point temperature. During ten tests run at approximately at the pump inlet were noted before complete pump performance 50 percent of the nominal operating speed, two phase conditions were achieved. Vapor volumes of 40 to 50 percent at the pump inlet were noted before complete pump performance loss. The experimental results compared to predictions. Nine cavitation tests run at the nominal pump speed over a 5 K temperature range showed progressively lower net positive suction head (NPSH) requirements as temperature was increased. Two-phase operation was not achieved. The temperature varying NPSH data were used to calculate thermodynamic effects on NPSH, and the results were compared to existing data. Author

**N73-33748*#** General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
**A STUDY OF ENGINE VARIABLE GEOMETRY SYSTEMS FOR AN ADVANCED HIGH SUBSONIC LONG RANGE COMMERCIAL AIRCRAFT**
M. A. Compagnon Oct. 1973 112 p refs
(Contract NAS3-15544)
(NASA-CR-134495; R73AER185) Avail: NTIS HC $7.75 CSCL 21E

Several variable geometry high Mach inlet concepts, aimed at meeting a system noise objective of 15 EPNdB below FAR part 36, for a long range, Mach 0.9 advanced commercial transport are assessed and compared to a fixed geometry inlet with multiple splitters. The effects of a variable exhaust nozzle (mixed exhaust engine) on noise, inlet geometry requirements, and economics are also presented. The best variable geometry inlet configuration identified is a variable cowl design which relies on a high throat Mach number for additional inlet noise suppression only at takeoff, and depends entirely on inlet wall treatment for noise suppression at approach power. Relative economic penalties as a function of noise level are also presented. Author

**N73-33749#** Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
**NEW RESULTS IN HIGH-ENERGY ROCKET ENGINE RESEARCH AND DEVELOPMENT [NEUE FORSCHUNGS- UND ENTWICKLUNGSERGEBNISSE AUF DEM GEBIET HOCHENERGETISCHER RAKETENANTRIEBE]**
Jul. 1972 92 p In GERMAN; ENGLISH summary Proc. of the DGLR Meeting Chemische Antriebe, Lampoldshausen, West Ger., 11 Mar. 1971
(DLR-MITT-72-09) Avail: NTIS HC $6.75; ZLDI, Munich 19,35 DM

Results of high energy rocket engine research and development are presented. Several unconventional liquid rocket propellants were analyzed to determine vapor pressure, viscosity, and thermal conductivity, with a view to optimizing engine design. Some experimental high energy rocket propellant combinations with heterogeneous combustion were investigated, and the performance of a FLOX/polyethylene engine is discussed. Hydrogen oxygen engines were tested for various propellant mixing ratios. Results of the long term development of booster rocket engines are presented. The application of plug and spike nozzles is discussed. For individual titles, see N73-33750 through N73-33754.

**N73-33750** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst: fuer Reaktionskinetik.
**DETERMINATION OF PHYSICO-CHEMICAL PROPERTIES OF UNCONVENTIONAL PROPELLANTS [BESTIMMUNG DER PHYSIKALISCH-CHEMISCHEN EIGENSCHAFTEN VON NICHTKONVENTIONELLEN TREIBSTOFFEN]** c27
F. Bachmaier *In* DGLR New Results in High-Energy Rocket Eng. Res. and Develop. Jul. 1972 p 7-20 In GERMAN (For availability see N73-33749 24-28)

The vapor pressures, viscosities, and thermal conductivities of several unconventional liquid rocket propellants were investigated in regard to rocket engine design. The systems examined were hydrazine methyl alcohol, dinitro tetroxide-tetranitro methane, and perchlorol fluoride-chlorine pentafluoride. The problems involved in the measurements are summarized, and the resulting equipment modifications are discussed. ESRO

**N73-33751** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
**ROCKET ENGINES BASED ON PROGRESSIVE HIGH-ENERGY PROPELLANTS [ANTRIEBE AUF DER BASIS FORTSCHRITTLICHER HOCHENER GETISCHER TREIBSTOFFE]**
R. Lo and R. Buchheim *In* DGLR New Results in High-Energy Rocket Eng. Res. and Develop. Jul. 1972 p 21-43 In GERMAN (For availability see N73-33749 24-28)

The performance of some experimental high energy rocket propellant combinations was investigated, as well as the performance of FLOX/polyethylene rocket engines. The combinations investigated were systems with lithium hydride as a fuel,

systems with binder-containing LiH systems with solid hydrocarbons, systems with binder-containing aluminum, systems with pure aluminum, and systems with mixtures of Al and LiH. As an example, the performance data of the metal-free hybrid polyethylene/fluoro/oxygen system are reported. ESRO

**N73-33752** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.

**PERFORMANCE TESTS OF LO2/GH2 ROCKET ENGINES [EXPERIMENTELLE UNTERSUCHUNGEN ZUM LEISTUNGSVERHALTEN VON LO2/GH2-RAKETENTRIEBWERKEN]**

H. J. Sternfeld *In* DGLR New Results in High-Energy Rocket Eng. Res. and Develop. Jul. 1972 p 45-71 In GERMAN (For availability see N73-33749 24-28)

Results of performance and combustion tests of experimental hydrogen oxygen engines for a variety of propellant mixing ratios and combustion chamber pressures are reported. Test equipment and procedures are described. A cooled engine was used. The combustion chamber consists of several segments of different lengths, in order to vary the characteristic chamber length. Test results are presented in graphical form. ESRO

**N73-33753** Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

**RESULTS AND DEVELOPMENT OF BOOSTER ROCKET ENGINES AT MBB [ERGEBNISSE AUS DEN ENTWICKLUNGSARBEITEN BEI MBB FUER HOCHDRUCKTRIEBWERKE]**

H. Dederra *In* DGLR New Results in High-Energy Rocket Eng. Res. and Develop. Jul. 1972 p 73-83 In GERMAN (For availability see N73-33749 24-28)

Results of the long term development of some booster rocket engines are presented. Test results of the following engines are mentioned: the 20T-LOX/LH2 engine, which was developed for the Europa 3 launch vehicle, the 5T-LOX/kerosene engine, the 13T-LOX/LH2 engine, and the 1T-N2O4 engine. ESRO

**N73-33754** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.

**UNCONVENTIONAL NOZZLES [UNKONVENTIONELLE DUESEN]**

J. Broschk *In* DGLR New Results in High-Energy Rocket Eng. Res. and Develop. Jul. 1972 p 85-92 In GERMAN (For availability see N73-33749 24-28)

Plug and spike nozzles are applied to rocket propulsion system configurations. Plug nozzles give an essentially better performance for low pressure ratios than conventional convergent-divergent nozzles as a result of the expanding jet's adaptation to the ambient pressure. The performance of spike nozzles under certain circumstances was specifically investigated with an experimental engine. ESRO

**N73-33755#** Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).

**BEHAVIOR OF TURBOJETS**

Jan. 1973 114 p refs In GERMAN; ENGLISH summary Proc. of the DGLR Airbreathing Propulsion Committee Meeting, Darmstadt, West Ger., 24 May 1972

(DLR-MITT-73-05) Avail: NTIS HC $7.75; ZLDI, Munich 23,95 DM

The influence of combustion chambers, compressors, and afterburners, and their mechanical configuration, on the static performance of two-cycle turbojet engines, with a high bypass ratio was investigated. Some examples are given to show the influence of the variation of both nozzle surfaces and fuel throughput at given thrust on the parameters of the same engines without primary and secondary flow mixing. The performance of arbitrarily switched gas turbines was calculated by simulation with building block system on a digital computer. The effects of a partly oil-filled converter for a turbine engine used to supply starting power to the main engines were investigated. For individual titles, see N73-33756 through N73-33759. ESRO

**N73-33756** Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).

**EFFECT OF SINGLE COMPONENTS AND THEIR MECHANICAL LAYOUT ON THE STATIC PERFORMANCE OF TWO-CYCLE TURBOJET ENGINES [EINFLUSS EINZELNER KOMPONENTEN UND IHRER MECHANISCHEN ANORDNUNG AUF DAS STATIONAERE BETRIEBSVERHALTEN VON 2-KREIS-TRIEBWERKEN]**

Hubert Grieb *In* DGLR Behavior of Turbojets Jan. 1973 p 7-50 In GERMAN (For availability see N73-33755 24-28)

The influence of combustion chambers, compressors and afterburners, and their mechanical configuration, on the static performance of two-cycle turbojet engines with a high bypass ratio, was investigated. As a basis for comparison of the thermodynamic cycling processes, maximal thrust with and without afterburning at sea altitude and a flight Mach number of 0.9 were chosen. The following conclusions were drawn with regard to the type of engine investigated: (1) within certain limits, a desired performance can be obtained with several thermodynamic designs; (2) the influence of the mechanical configuration of the turbopart in the static performance is small; (3) the technological state-of-the-art of the components is essential for the quality of stationary operating characteristics; (4) the optimal tuning of the compressor characteristics to the expected load lines has considerable influence on the operation; (5) the design of low pressure compressor transition to medium pressure compressor and (6) bypass channel needs special attention besides mechanical conception. ESRO

**N73-33757** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Luftsaugende Antriebe.

**PERFORMANCE BEHAVIOR OF A TWO-CYCLE TURBOJET ENGINE FOR MULTIPARAMETER CONTROL [DAS LEISTUNGSVERHALTEN EINES ZWEISTROMTRIEBWERKS BEI MEHRGROESSENREGELUNG]**

Heinrich Dissen *In* DGLR Behavior of Turbojets Jan. 1973 p 55-72 In GERMAN (For availability see N73-33755 24-28)

Some examples are given to show the influence of the variation of both nozzle surfaces and fuel throughput at given thrust and other boundary conditions on the engine parameters of a two-cycle turbojet engine with large bypass ratio without primary and secondary flow mixing. To this end, a computation method was developed for describing the performance of engines with multiparameter control. The advantages of multiparameter control are summarized. The disadvantages are: the system is more complicated, adjustable nozzles add to the engine weight, and accurate measurements are necessary for determining the engine parameters. ESRO

**N73-33758** Kloeckner-Humboldt-Deutz A.G., Oberursel (West Germany)

**PERFORMANCE CALCULATION OF ARBITRARILY SWITCHED GAS TURBINES WITH BUILDING BLOCK SYSTEM ON DIGITAL COMPUTER [KENNFELDRECHNUNG FUER GASTURBINEN BELIEBIGER SCHALTUNG MIT EINEM BAUKASTENSYSTEM AUF DIGITALER RECHENMASCHINE]**

Karl-Heinz Collin *In* DGLR Behavior of Turbojets Jan. 1973 p 77-97 In GERMAN (For availability see N73-33755 24-28)

In order to determine the optimal component switching configuration of gas turbines, a method was developed to determine the performance characteristics, by simulating arbitrarily switched gas turbines using a building block system on a digital computer. The calculation is based on component characteristics and their theoretical flow models in a mathematical form. The turbine cycle process was split up into its components, for each of which a fixed program was written. With these component programs, every desirable circuit can be set up by connection in order of flow. This building block system is described, exemplified for a single and double shaft system, and the role of a correction program is indicated. ESRO

**N73-33759** Kloeckner-Humboldt-Deutz A.G., Oberursel (West Germany).

**OBSERVATIONS OF A PARTLY FILLED HYDRODYNAMIC CONVERTER DURING THE STARTING PROCESS [BEOBACHTUNGEN AN EINEM STROEMUNGSWANDLER BEI TEILFUELLUNG WAEHREND DES ANFAHRENS]**

Friedrich Homola and Gottfried Schwarz *In* DGLR Behavior of Turbojets Jan. 1973 p 99-113 In GERMAN (For availability

see N73-33755 24-28)

**The effects of a partly oil-filled hydrodynamic converter for a** single-shaft gas turbine, were investigated during the process of starting up the main engines. A converter is necessary to obtain a constant power supply. When electric power is extracted, the converter is filled with oil in order to gradually decrease power by energy dissipation during the starting process. Emptying takes place automatically after a certain time. As the acceleration processes take place only during 10 to 20 seconds, the filling and emptying of the converter is of great importance. In particular, the effects of a partially filled converter were investigated. It was found that care must be taken in applying hydrodynamic converters. ESRO

**N73-33760#** Naval Postgraduate School, Monterey, Calif.
**AN ANALYTICAL MODEL FOR PREDICTING THE DAILY TEMPERATURE CYCLE OF CONTAINER STORED ORDNANCE Final Report, 1972 - 1973**
Thomas E. Cooper and Allen H. Wirzburger 18 Jun. 1973 68 p refs
(AD-764536; NPS-59CG73061A) Avail: NTIS CSCL 21/8

The heat transfer characteristics of a container stored rocket motor have been investigated using analytical and experimental techniques. Comparison between analytically predicted and experimentally determined values of temperature are within the estimated experimental uncertainty of plus or minus 3F. The results of the analytical solution may be used to predict maximum and minimum temperatures, thermal time lags, and temperature gradients throughout the rocket motor. For convenience, maximum temperature and time lag information is presented in nomograph form as a function of three parameters: normalized radial location, normalized frequency, and normalized gap conductance. These three parameters control the temperature behavior of the motor. It is proposed that the nomographs will be a useful tool for thermally optimizing future container designs. Author (GRA)

**N73-33761#** Pratt and Whitney Aircraft, East Hartford, Conn.
**INFLUENCE OF VARIABLE TURBINE GEOMETRY ON ENGINE INSTALLATION LOSSES AND CYCLE SELECTION Final Technical Report, Apr. 1971 - Nov. 1972**
Robert J. May, Jr. and William F. Zavatkay Jun. 1973 34 p Presented at 8th JANNAF/AIAA/SAE Propulsion Joint Specialist Conf., New Orleans, La., 27 Nov. - 1 Dec. 1972 Sponsored by AF
(AF Proj. 3066)
(AD-765533; AFAPL-TR-73-18) Avail: NTIS CSCL 21/5

The trend in military aircraft is toward increasing thrust loading for improved maneuverability coupled with a requirement for extended subsonic cruise range at low power settings. Conventional turbine engines designed to meet these requirements must operate over large ranges of airflow between maximum power and cruise. As a result, the inlets and nozzles designed for these engines cannot perform efficiently with the low airflow rates typical of subsonic cruise operation. Variable turbine geometry, however, offers a promising approach for obtaining both high thrust loading and efficient cruise performance by permitting large amounts of thrust modulation at constant airflow rates. As an example, the performance of a turbojet engine, which provides efficient high-thrust maneuvering and supersonic operation, can be improved by variable turbine geometry to the point where it is competitive with a fixed-turbine-geometry turbofan engine in the low-thrust subsonic cruise regime. (Modified author abstract) GRA

**N73-32961*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**QUIET STOL PROPULSION SESSION INTRODUCTORY REMARKS**
Robert W. Schroeder *In its* STOL Technol. 1972 p 367-370 (For availability see N73-32934 24-02)
CSCL 20A

**N73-32962*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ENGINE NOISE TECHNOLOGY**
Roger W. Luidens, Donald R. Dietrich, James H. Dittmar, Richard G. Goldman, William A. Olsen, Jr., and Brent A. Miller *In its* STOL Technol. 1972 p 371-412 refs (For availability see N73-32934 24-02)
CSCL 21A

**N73-32967*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**STOL PROPULSION SYSTEMS**
Robert J. Denington, Robert W. Koenig, Michael R. Vanco, and David A. Sagerser *In its* STOL Technol. 1972 p 475-509 ref (For availability see N73-32934 24-02)
CSCL 21A

# 29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

**N73-33762#** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).
**MEDITERRANEAN COOPERATION FOR SOLAR ENERGY, BULLETIN NO. 22 [COOPERATION MEDITERRANEENNE POUR L'ENERGIE SOLAIRE, BULLETIN NO. 22]**
Mar. 1972 91 p refs In FRENCH
(Bull-22) Avail: NTIS HC $6.75

Conference data on the use of solar energy in the Mediterranean are presented. Various techniques and equipment are also described. For individual titles, see N73-33763 through N73-33773.

**N73-33763** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).
**NEW HELIOTECHNIQUE [LA NOUVELLE HELIOTECHNIQUE]**
M. Touchais *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 5-7 In FRENCH (For availability see N73-33762 24-29)

Utilization of solar energy on earth using an old and new heliotechnique is discussed. Data cover industrial applications and light and heat sources for homes. The economics of using solar energy is also examined. Transl. by E.H.W.

**N73-33764** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).
**FLOAT SUPPORT NECESSARY TO CAPTURE SOLAR RADIATION [DU SUPPORT FLOTTANT NECESSAIRE A LA CAPTATION DU RAYONNEMENT SOLAIRE]** **c11**
S. Leonard *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 9-10 In FRENCH (For availability see N73-33762 24-29)

The possibility of designing and building floating platforms to harness and use solar radiation is explored. A study was also made of: (1) efforts to channel solar radiation in a predetermined location, (2) methods of obtaining power to account for oceanographic, geographic, and geophysical parameters, and (3) solar rays before they backlash. Transl. by E.H.W.

**N73-33765** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).
**THALLASSIC AND THE ARTIFICIAL RISE OF WATER [THALASSIES ET REMONTEES D'EAU ARTIFICIELLES]** **c13**
H. Boutiere and J. Vasserot *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 11-15 In FRENCH (For availability see N73-33762 24-29)

Water upwelling and its origin are studied in Peru, the Gulf of Mexico, and along the coast of Northwest and South Africa. The effects of surface winds, current depth, and mass transport on upwelling are discussed along with the influence of temperature gradients. Vertical water transport is also studied.
Transl. by E.H.W.

**N73-33766** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).
**CALCULATION OF USEFUL ENERGY IN A SYSTEM CONCENTRATED WITH SOLAR RADIATION AND PROVI-**

**SION FOR OPERATING IT SEVERAL YEARS [CALCUL DE L'ENERGIE UTILE D'UN SYSTEME DE CONCENTRATION DU RAYONNEMENT SOLAIRE ET PREVISION DE SON FONCTIONNEMENT REPETE PENDANT PLUSIEURS ANNEES]**

J. G. Sakas *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 17-26 In FRENCH (For availability see N73-33762 24-29)

An analog method is presented that calculates useful solar energy stored by a thermocollector located in Athens. Calculations are based on time, known energy, constant temperature, and density of direct solar rays. Transl. by E.H.W.

**N73-33767** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).

**REFLECTIONS ON HELIOTHERMIC TRANSFORMATION OF DIRECT SOLAR RADIATION [REFLEXIONS SUR LA TRANSFORMATION HELIOTHERMIQUE SOUS RAYONNEMENT CONCENTRE]**

A. Hima and D. Pailharey *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 27-34 refs In FRENCH (For availability see N73-33762 24-29)

Heliothermic transformation of solar electromagnetic radiation so that it can be used for heating purposes is discussed. Specifically, theories and formulas are proposed to aid in fabricating equipment to convert direct solar energy into heat for industrial use. Transl. by E.H.W.

**N73-33768** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).

**ARID ZONE CULTIVATION AND GREENHOUSES-SOLAR DISTILLERS [CULTURES EN ZONE ARIDE ET SERRES-DISTILLATEURS SOLAIRES]** **c11**

H. Boutiere *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 35-56 In FRENCH (For availability see N73-33762 24-29)

An attempt was made to grow vegetables in the Sahara using a controlled greenhouse and irrigation. The greenhouse assemblies and their operation are described. Organic materials added to the soil and a list of the vegetables produced are included. Transl. by E.H.W.

**N73-33769** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).

**SOLAR STILL GREENHOUSE: A PROPOSAL FOR USING DESALINATED WATER FOR AGRICULTURAL PURPOSES** **c11**

Van-Vi Tran, M. Kudret Selcuk, Mehmet Akyurt, Mehdi Shariat, Ustuen Oztoker, and Necdet Toraman *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 57-68 refs (For availability see N73-33762 24-29)

A solar still greenhouse assembly is described. Fundamentals of the mathematical formulation for the prediction of the solar still greenhouse temperatures and distillation and evapotranspiration rates are presented and the solution of the models is outlined. An experimental arrangement, for the verification of the theory established, was constructed and tests were run from August to September 1971. Tests results are reported and compared with computed values and discrepancies are discussed. Author

**N73-33770** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).

**ECOLOGY, ENVIRONMENT, AND HELIOTECHNIQUE [ECOLOGIE, ENVIRONMENT ET HELIOTECHNIQUE]**

H. Boutiere *In its* Mediterranean Cooperation for Solar Energy, Bull. no 22 Mar. 1972 p 69-73 In FRENCH (For availability see N73-33762 24-29)

A heliotechnique that deals with ecology in respect to the thermodynamic and biological role of the sun on earth processes is proposed. In particular, pollution induced disturbances in the energy balance and production allowances and maintenance rate of oxygen in the atmosphere are discussed. Transl. by E.H.W.

**N73-33771** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).

**LUMIDUC ARCHITECTURE**

Guy Rottier *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 75-81 In FRENCH (For availability see N73-33762 24-29)

Techniques are presented that allow solar radiation to be canalized and used to light certain internal areas of houses. Various designs are included. Transl. by E.H.W.

**N73-33772** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).

**DETERMINATION OF A FILTER DESIGNED TO DETECT SOLAR SPECTRA BETWEEN THE TWO LONG WAVE SPECTRAL BANDS 0.3 TO 0.4 MICRONS AND 0.6 TO 0.7 MICRONS [DETERMINATION D'UN FILTRE DESTINE A ISOLER DANS LE SPECTRE SOLAIRE DEUX BANDES SPECTRALES COMPRISES ENTRE LES LONGUEURS D'ONDE 0.3-0.4 MICRONS ET 0.6-0.7 MICRONS]**

F. Papini and B. Imbert *In its* Mediterranean Cooperation for solar Energy, Bull. no. 22 Mar. 1972 p 83-86 In FRENCH (For availability see N73-33762 24-29)

A filter designed to determine solar reflectance, density, and optical properties of flat and curred surfaces is described. Plant surface and thin boundary layers were studied in the long wave band between 0.3 to 0.4 and 0.6 to 0.7 microns. Results are given in graphical form. Transl. by E.H.W.

**N73-33773** Cooperation Mediterraneenne pour l'Energie Solaire, Marseille (France).

**TEMPERATURE MEASUREMENT OF SEA WATER, AIR, AND INCIDENT SOLAR ENERGY [MESURES DE LA TEMPERATURE DE L'EAU DE MER, DE L'AIR ET DE L'ENERGIE SOLAIRE INCIDENTE]**

A. Hatzikakidis and L. Caloumenos *In its* Mediterranean Cooperation for Solar Energy, Bull. no. 22 Mar. 1972 p 87-92 refs In FRENCH (For availability see N73-33762 24-29)

Air-sea interactions, and their temperature effects related to incident solar rays are measured. Measured data are presented in tabular form for the years 1961 to 1965. Transl. by E.H.W.

**N73-33774** Texas Univ., Austin.

**MONTE CARLO TREATMENT OF LYMAN ALPHA RADIATION Ph.D. Thesis**

Sarma Brahmananda Modali 1972 139 p

Avail: Univ. Microfilms Order No. 73-18472

A Monte Carlo technique involving Stokes vectors is used to obtain the state of polarization and intensity of solar Lyman-alpha photons as they diffuse through a plane parallel homogeneous model of earth's hydrogen envelope. The results (state of polarization and intensity) are compared with the available observations and with the theoretical calculations of previous investigations. The polarization values presented at optical depths greater than 1, for Rayleigh scattering, are new results. The present investigation finds that an optical depth greater than seven is required for the hydrogen in the upper atmosphere above 200 km, in order to fit Heath's observed upper limit of 1.5% for the degree of polarization. A final conclusion also apparent from this investigation is that higher orders of scattering contribute a residual polarization which is not negligible, even for large optical depths of the order of 10. Dissert. Abstr.

**N73-33775** Maryland Univ., College Park.

**GALACTIC WINDS DRIVEN BY COSMIC RAYS Ph.D. Thesis**

Fred Michael Ipavich 1972 50 p

Avail: Univ. Microfilms Order No. 73-18245

Cosmic rays traveling with mean velocity greater than the Alfven speed can generate magnetohydrodynamic waves, which in turn scatter the cosmic rays and reduce their anisotropy. In the process, the waves are amplified by the cosmic rays and damped by the background medium (thermal gas). Thus the cosmic rays become coupled to the thermal gas, and cosmic rays escaping from a galaxy tend to drag along thermal gas. As a result, the thermal gas is heated and accelerated, producing what has been called a galactic wind although cosmic rays have never been considered the driving force in a galactic wind. The types of steady galactic winds to be expected when cosmic rays escape from a galaxy are described. Dissert. Abstr.

**N73-33776*#** Franklin Inst., Swarthmore, Pa. Bartol Research Foundation.

**STRUCTURAL AND SPECTRAL STUDIES OF SUNSPOTS**
**Annual Report, 1 Sep. 1972 - 1 Sep. 1973**
Arne A. Wyller 3 Oct. 1973 57 p refs
(Grant NGR-39-005-066)
(NASA-CR-135787) Avail: NTIS HC $5.00 CSCL 03B

The work is reported in the multicolor photometry of umbral cores, and the residual intensity midway between the Na D1 and D2 lines. The photelectric magnetometer observations, the generation of umbral flashes and penumbral running waves, and the work on sunspot interior modes with Alfen wave emission are discussed. F.O.S.

**N73-33777*#** California Inst. of Tech., Pasadena.
**A SATELLITE MEASUREMENT OF COSMIC-RAY ABUNDANCES AND SPECTRA IN THE CHARGE RANGE 2 LESS THAN OR EQUAL TO 7 LESS THAN OR EQUAL TO 10 Ph.D. Thesis**
James William Brown Jun. 1973 118 p refs
(Contract NAS5-9312; Grant NGR-05-002-160)
(NASA-CR-135786; SRL-73-2) Avail: NTIS HC $8.00 CSCL 03B

The composition of the nuclear component of the cosmic radiation was studied to yield information concerning the source, propagation, and confinement of cosmic rays within the galaxy. The first comprehensive satellite measurement is presented of cosmic-ray composition and spectra in the charge range 2 equal to or less than Z equal to or less than 10 using the geomagnetic field as a rigidity analyzer through the entire range of vertical cutoffs. The results indicate that the spectra of all the elements in the observed range are similar, and thus that various ratios of elemental abundances are nearly independent of rigidity over the range 2 equal to or less than P equal to or less than 15 GV. Calculations of the propagation of cosmic rays through the interstellar and interplanetary media predict that there should be a variation with rigidity of ratios of various elements, because of the charge-dependent effects of ionization of the interstellar gas by the cosmic rays. The absence of this variation can be explained by assuming a rigidity-dependent confinement of the cosmic rays in the galaxy. Author

**N73-33778*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SAS-2 OBSERVATIONS OF GAMMA RAYS FROM THE GALACTIC PLANE**
D. A. Kniffen, R. C. Hartman, D. J. Thompson, and C. E. Fichtel Sep. 1973 12 p refs Submitted for publication
(NASA-TM-X-70486; X-662-73-299) Avail: NTIS HC $3.00 CSCL 03B

The SAS-2 gamma ray experiment has made measurements on the high energy gamma rays coming from the galactic center region. The gamma radiation in this region is very much more intense than in the anticenter region, in agreement with the observations made with the OSO-3 experiment of Kraushaar et al. (1973); and exhibits a narrow distribution along the plane which is nearly uniform in intensity from 330 deg to 30 deg. The energy spectrum in the range from 35 MeV to 210 MeV is quite flat, consistent with a cosmic ray-interstellar matter interaction pion-decay spectrum, or a mixture of this spectrum and a spectrum formed by Compton radiation from cosmic ray electrons. The intensity of the radiation in the anticenter direction is consistent with that expected from the cosmic ray-interstellar matter interaction origin, namely 0.000.002 photons. Author

**N73-33779*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**CELESTIAL DIFFUSE GAMMA RADIATION ABOVE 30 MeV OBSERVED BY SAS-2**
C. E. Fichtel, D. A. Kniffen, and R. C. Hartman Sep. 1973 12 p refs Submitted for publication
(NASA-TM-X-70485; X-662-73-298) Avail: NTIS HC $3.00 CSCL 03B

The Small Astronomy Satellite (SAS)-2, launched on November 15, 1972, carried into orbit a 32-deck magnetic-core digitized spark chamber gamma ray telescope to study celestial gamma radiation in the energy range above 30 MeV. In the study of several regions with b sub 2 > 15 deg, a finite, diffuse flux of gamma rays with a steep energy spectrum in the energy region from 35 to 200 MeV is observed. Representing the energy spectrum by a power law of the form dJ/dE = AE to - alpha power over this energy range, alpha is found along with the integral flux above 100 MeV. Combining this result with existing low energy gamma ray data yields an energy spectrum which is not a simple power law in energy, as in the X-ray region, but which demonstrates first an increase and then a decrease in slope, consistent within uncertainties with that predicted by cosmological theories, including the continuous production of high energy gamma rays primarily from neutral pi mesons throughout the history of the universe. Author

**N73-33780*#** Linguistic Systems, Inc., Cambridge, Mass.
**DETERMINATION OF THE PERTURBING MOMENTS DUE TO SOLAR RADIATION PRESSURE FORCES ACTING ON A BODY OF REVOLUTION**
Ye. N. Polyakhova Washington NASA Oct. 1973 17 p Transl. into ENGLISH from Tr. Astron. Observ. (Leningrad), v. 29, 1973 p 152-163
(Contract NASw-2482)
(NASA-TT-F-15072) Avail: NTIS HC $3.00 CSCL 03B

The simple approximate formulas are used for the determination of the perturbing torques due to solar radiation pressure forces for a symmetrical satellite (body of revolution). Two types of formulas are discussed for the forces which are directed: (1) to the light flow, (2) normal to the body surface. The general supposition is that the light flow lies in the plane of symmetry of a satellite contained in the spin axis. The formulas are used for torque determination of conical and paraboloidal satellites. Author

**N73-33781*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SOLAR FLARE EMISSIONS AND GEOPHYSICAL DISTURBANCES**
Kunitomo Sakurai Sep. 1973 109 p refs
(NASA-TM-X-70479; X-693-73-277) Avail: NTIS HC $7.50 CSCL 03B

Various geophysical phenomena are produced by both wave and particle emissions from solar flares. Using the observed data for these emissions, a review is given on the nature of solar flares and their development. Geophysical phenomena are discussed by referring to the results for solar flare phenomena. Author

**N73-33782#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**PENETRATION OF SOLAR COSMIC RAYS INTO EARTH'S POLAR CAPS**
Iu. V. Gotsekiuk, S. N. Kuznetsov, Iu. I. Logachev, I. A. Savenko, and V. G. Stolpovskii [1973] 5 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 11, no. 4, 1973 p 635-638
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Solar cosmic flares with Ep greater than 1 Mev and proton fluxes with Ep greater than 1.1 were recorded in the earth's polar caps by the Cosmos-378. A detailed time profile of solar cosmic flare rise could not be established from Cosmos data. However, a comparison between Venera-7 and Cosmos-378 data show polar proton flares in the polar caps and in the region of Venus orbit did not differ by more than 1.5 to 2 fold. Some characteristics of solar protton penetration in the earth's polar caps were recorded. Author

**N73-33783#** Oak Ridge National Lab., Tenn.
**MEASUREMENT OF THE NEUTRON ENERGY SPECTRUM AT 9 g/sqcm RESIDUAL ATMOSPHERE**
W. Zobel, T. A. Love, J. R. DeLorenzo, C. O. McNew, R. H. Baldry, and H. W. Parker Jun. 1973 43 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3877) Avail: NTIS HC $4.25

An experiment to measure the neutron energy spectrum at an altitude corresponding to 9 g/cm2 residual atmosphere was performed near solar maximum. The nondirectional spectrometer employed was flown at geomagnetic latitude 40 N from Palestine, Texas, on June 17, 1969. The experimental arrangement is described, the data reduction scheme is discussed, and the results are presented for the neutron spectrum in the energy

range from 3 to 60 MeV. The spectrum is compared with those from other experiments and from calculations. The intensity is greater than the calculations of Lingenfelter after application of an altitude correction. Author (NSA)

**N73-33784#** Atomic Energy Commission, New York. Health and Safety Lab.
**LUIN, A CODE FOR THE CALCULATION OF COSMIC RAY PROPAGATION IN THE ATMOSPHERE**
K. OBrien May 1973 23 p refs
(HASL-275) Avail: NTIS HC $4.00

An analytical straight-ahead transport code, LUIN, was developed for the calculation of cosmic ray spectra, fluxes, and ionization in the earth's atmosphere. The input to the code is described, along with an ancillary code to prepare the angle-dependent rigidity cut-off input. LUIN takes into account solar modulation, the geomagnetic field, atmospheric temperature, altitude, and the curvature of the earth. The code is written in FORTRAN the CDC 6600. Author (NSA)

**N73-33785#** Oslo Univ. (Norway). Inst. for Teoretisk Astrofysikk.
**CORRECTION OF SOLAR INTENSITY MEASUREMENTS FOR STRAY LIGHT**
L. Staveland 1972 35 p refs
(NP-19735) Avail: AEC Depository Libraries HC $3.75

A computer program is described which corrects the observed intensity in the center of an elliptical sunspot for stray light. The program also corrects the observed intensity profile of the solar limb. The analytical expression used for the relative solar limb darkening gives three to four correct digits for the Harvard-Smithsonian Reference Atmosphere (HSRA) model in the wave-lenth region 0.3 to 5.0 microns for cos theta = 0.1 to cos theta = 0.3. Author (NSA)

**N73-33786#** Brookhaven National Lab., Upton, N.Y. Technical Information Div.
**PROBLEM OF SOLAR NEUTRINOS**
M. G. Shchepkin 1973 9 p refs Transl. into ENGLISH from Zh. Eksperim, Teor. Fiz. (Moscow), v. 17, no. 4, 1973 p 262-229
(BNL-tr-538) Avail: NTIS HC $3.00

A mechanism is considered which would explain the low counting rates for solar neutrinos. Temperature fluctuations in the solar interior may cause the neutrino luminosity to change sharply with time while the photon luminosity remains essentially constant due to the large time lag of diffusion. NSA

**N73-33787#** Oslo Univ. (Norway). Inst. for Theoretisk Astrofysikk.
**CORRECTION OF OBSERVED PENUMBRAL INTENSITIES FOR SCATTERED LIGHT**
P. Maltby and L. Staveland 1972 13 p refs
(NP-19732) Avail: AEC Depository Libraries HC $3.00

A simple method for correcting the observed penumbral intensities for light scattered in the atmosphere and the instrument is described. The correction is found to be proportional to the relative intensity at a fixed position outside the solar limb. The proportionality factor depends on the observing wavelength as well as the intensity gradient of the aureole. Aithor (NSA)

**N73-33788#** Osservatorio Astronomico, Rome (Italy).
**SOLAR PHENOMENA Monthly Bulletin, Apr. 1973**
Massimo Cimino Apr. 1973 11 p
(Publ-180) Avail: NTIS HC $3.00

Solar data for April 1973 are presented. Tables include: daily total areas of sunspot groups; heliographic position, classification and area of sunspot groups; longitudinal sunspot magnetic fields, and hours of K-line cinematographic patrol. ESRO

**N73-33789#** Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
**COSMIC GAMMA RAYS [KOSMISCHE GAMMASTRAHLEN]**
K. Pinkau May 1973 28 p refs In GERMAN
(MPI-PAE/Extraterr-83) Avail: NTIS HC $3.50

The sources discussed are: synchrotron radiation from electrons and magnetic field interactions, inverse Compton effect from electrons and photon field interactions, bremsstrahlung from electron and matter interactions, nuclear interactions, and annihilation reactions. Gamma absorption by interactions with radiation and matter is discussed. Detection by means of photo effect, compton effect, and pair formation is dealt with. Observation results are outlined. ESRO

**N73-33790#** California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
**PROJECT THEMIS SUMMARY Final Technical Report, 1 Jul. 1969 - 30 Jun. 1973**
R. Stephen White Jul. 1973 44 p refs
(Contract N00014-69-A-0200-5001; NR Proj. 387-047) (AD-764599; IGPP-UCR-73-32) Avail: NTIS CSCL 04/1

Project Themis (The Variations in the Earth's Atmosphere Produced by Solar Radiations at UCR) has contributed significant additional knowledge to the properties of the sun and the interaction of the sun's radiation with the atmosphere, the chemistry of the atmosphere, climatology and computer studies for remotely sensed imagery. The summaries of the scientific accomplishments are given in section 2 for each of the experiments. The reports and publications directly related to the Themis research are given in section 3. The students and faculty that were supported by the Themis program are listed in section 4. GRA

# 30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

**N73-33791** Texas Univ., Austin.
**A STUDY OF THE KINEMATIC PROPERTIES OF CARBON STARS Ph.D. Thesis**
Charles Atkins Dean 1972 198 p
Avail: Univ. Microfilms Order No. 73-18416

Fundamental data for this dissertation consist of radial velocities and spectral types of carbon stars based on 424 spectra obtained with the 36-inch (91-centimeter) reflector at the McDonald Observatory. All observations were the Meinel spectrograph and Carnegie S-20 image tube. Radial Velocities were measured for 225 program stars and 91 radial Velocity and classification standard stars. The radial velocity standard stars served to standardize the radial velocity system with that of Sanford's in order that his 283 radial velocities could be included in the kinematic analysis. Computer programs were written to determine the solar motion, differential galactic rotation, and velocity ellipsoid parameters. With these programs and the available data, the kinematic properties of various categories of carbon stars were determined. The results of these analyses indicates that the carbon stars are kinematically homogeneous, with the exception of early-type (CO-C4) and Mira variable carbon stars. Dissert. Abstr.

**N73-33792** Princeton Univ., N.J.
**DYNAMICS OF ROTATING STELLAR SYSTEMS: COLLAPSE AND VIOLENT RELAXATION Ph.D. Thesis**
John Richard Gott, III 1972 66 p
Avail: Univ. Microfilms Order No. 73-18761

A method for following the dynamics of axisymmetric stellar systems is developed and applied to the problem of collapse and violent relaxation in rotating stellar systems. Utilization of an axisymmetric gravitational potential allows treatment of many more stars than would be feasible with a simple N-body calculation. Systems having differing amounts of initial angular momentum and containing 2000 stars each are allowed to collapse under their own gravitational attraction. Collapse and violent relaxation are found to lead to the formation of equilibrium structures after only a few free fall times. The systems contain a sufficient number of stars so as to be effectively collisionless and the equilibrium structures are consistent with

accurate satisfaction of the stationary collisionless Boltzmann equation. Dissert. Abstr.

**N73-33793** Illinois Univ., Urbana.
**A SURVEY OF THE PROPERTIES OF SUPERNOVA REMNANTS Ph.D. Thesis**
Anthony Gordon Willis 1972 209 p
Avail: Univ. Microfilms Order No. 73-17473

Sixteen galactic supernova remnants have been mapped at a frequency of 2.7 GHz with a 93 meter ratio telescope. The resolution, about 5.2 minutes of arc, is the highest yet attained on many of the sources. Additional observations of some of the remnants have been made at a frequency of 1665 MHz with a 37 meter telescope. The 2.7 GHz measurements are combined with other data available in the literature in order to search for common characteristics of the remnants and evidence HB 21, good positional correspondence between the region of the peak volume emissivity at 2.7 GHz and the site of the optical filaments is found in those remnants exhibiting optical emission. Dissert. Abstr.

**N73-33794** Oklahoma State Univ., Stillwater.
**MONTE CARLO ANALYSIS OF THE RADIO SOURCE COUNTS FROM THE OHIO SURVEY AT 1415 MHz Ph.D. Thesis**
Chunchanakatte Melukote Ramakrishna 1973 208 p
Avail: Univ. Microfilms Order No. 73-18942

A Monte Carlo analysis was made to determine the errors in flux density and position of radio sources in the Ohio Survey. The corrections to the flux density found were applied to correct the radio source counts from the Ohio Surveys 2 through 5. 75 artificial point sources, called Monte Carlo sources, were inserted at flux densities of 0.05, 0.10, 0.15, 0.20, 0.30, 0.50, 0.70, 1.00 and 4.00 f.u., taking one flux level at a time, of the Ohio Survey. Selecting a few strong point sources from Survey V the beam pattern of the O.S.U. radio telescope were determined. Using this antenna pattern Monte Carlo sources were generated and combined with the raw data. The modified data were analysed in exactly the same way as were the original data. From the resulting radio source maps, called Monte Carlo maps, sources were selected and their flux and positions determined. Each Monte Carlo map was compared with the original map and the Monte Carlo sources extracted. Noting the differences in the detected flux and positions as compared to the original the systematic and the RMS errors in flux and position were computed. From the percentage of sources lost and errors in flux densities the corrections the corrections to the number counts were determined. Dissert. Abstr.

**N73-33795** California Univ., San Diego.
**GAS FLOW IN GALAXIES AND CLUSTERS Ph.D. Thesis**
James Christopher Baker 1973 222 p
Avail: Univ. Microfilms Order No. 73-18213

Numerical calculations, using hydrodynamic equations, were made of the flow of gas ejected from stars in elliptical galaxies, galactic accerion, and galactic wind velocity and direction in cluster galaxies. Dissert. Abstr.

**N73-33796** Toledo Univ., Ohio.
**THE SURFACE BRIGHTNESS OF REFLECTION NEBULAE Ph.D. Thesis**
William Fredrick Rush 1972 123 p
Avail: Univ. Microfilms Order No. 73-19052

Hubble's equation relating the maximum apparent angular extent of a reflection nebula to the apparent magnitude of the illuminating star was reconsidered under a set of less restrictive assumptions. A computational technique is developed which permits the use of fits to observed m, log a values to determine the albedo of the particles composing reflection nebulae, providing only that one assumes a particular phase function. Despite the fact that all orders of scattering, anisotropic phase functions, and illumination by the general stellar field are considered, the albedo which is determined for reflection nebulae by this method appears larger than that for interstellar particles in general. The possibility that the higher surface brightness might be due to a continuous fluorescence mechanism is considered both theoretically and observationally. From the observations, the ratio of fluorescent to reflected contribution to nebular surface brightness is found to be zero with an rms deviation corresponding to .1. The calculations indicate that this ratio must be at least .3 if the albedo of nebular particles is to be the same as the albedo of general interstellar particles. Dissert. Abstr.

**N73-33797** Wisconsin Univ., Madison.
**MEASUREMENT OF THE D/H RATIO IN THE ATMOSPHERE OF JUPITER WITH A PEPSIOS SPECTROMETER Ph.D. Thesis**
John Terry Trauger 1973 80 p
Avail: Univ. Microfilms Order No. 73-15994

An estimate of the D/H ratio in the atmosphere of Jupiter has been made on the basis of an investigation of the sparse Jovian H2 quadrupole and HD dipole spectra between 6300 and 7500 A with an off-axis PEPSIOS spectrometer. The off-axis PEPSIOS, which was developed and first used in connection with this experiment, makes it possible to compensate for the Doppler shifts in the Jovian spectrum which result from its rapid rotation. As a consequence, it is possible to collect the light from the entire Jovian disk without degrading the spectral resolution. The characteristics of the Doppler compensating instrument that were essential in this experiment were an order of magnitude increase in light available to the spectrometer at the resolutions used compared to conventional spectrometers, and the property of the instrument which makes the solar and terrestrial lines normally present in the Jovian spectrum appear broad compared to planetary lines. Dissert. Abstr.

**N73-33798** Texas Univ., Austin.
**OPTIMAL THREE DIMENSIONAL REENTRY TRAJECTORIES FOR SHUTTLE-TYPE VEHICLES Ph.D. Thesis**
Ronald Wilson Greene 1972 110 p
Avail: Univ. Microfilms Order No. 73-18432

The perturbation method, a numerical optimization technique, is used to compute optimal three dimensional reentry trajectories for shuttle-type vehicles. In this study, the earth is assumed to be spherical, non-rotating, and to possess an inverse square gravitational force field. The atmosphere is assumed to be at rest with respect to the earth and its density is assumed to vary exponentially with altitude. The vehicle is controlled by modulation of the roll angle which determines the direction of the aerodynamic lift force and by variation of the angle of attack which determines the magnitude of the aerodynamic force coefficients. The aerodynamic lift and drag coefficients are assumed to be functions only of angle of attack and to be those obtained from Newtonian flow theory. Dissert. Abstr.

**N73-33799** Illinois Univ., Urbana.
**OPTIMAL MULTIPLE-IMPULSE DIRECT ASCENT RENDEZVOUS Ph.D. Thesis**
Larry Raymond Gross 1972 115 p
Avail: Univ. Microfilms Order No. 73-17222

Minimum fuel, multiple impulse, direct ascent rendezvous trajectories with a specified transfer time are investigated. The target's orbit is a circle about a spherical nonrotating planet. The angle between the launch point and the target's orbital plane, the radius of the target's orbit and the target's position at launch and at rendezvous are parameters varied in this study. A general method for obtaining fuel optimal, impulsive, fixed time trajectories is presented. The method is based on a comparison of two neighboring trajectories, a nonoptimal reference trajectory and a comparison trajectory. The properties of the primer vector along the reference trajectory provides information about the relative position of the comparison trajectory necessary to achieve a first order decrease in fuel cost. This information is used in a first order numerical minimization scheme to compute an optimal trajectory. Dissert. Abstr.

**N73-33800** California Inst. of Tech., Pasadena.
**CONSERVED QUANTITIES AND THE FORMATION OF BLACK HOLES IN THE BRANS-DICKE THEORY OF GRAVITATION Ph.D. Thesis**
John Joseph Dykla 1973 84 p
Avail: Univ. Microfilms Order No. 73-18372

A symmetric stress-energy-momentum pseudo-tensor for the gravitational fields of Brans-Dicke theory was constructed and used to establish rigorously conserved integral expressions for energy-momentum and angular momentum. Application of the

two-dimensional surface integrals to the exact static spherical vacuum solution of Brans leads to an identification of the conserved mass with the active gravitational mass. Application to the distant fields of an arbitrary stationary source reveals that the energy-momentum and the angular momentum have the same physical interpretation as in general relativity. The theory that relativistic gravitational collapse in three dimensions produces black holes identical to those of general relativity is developed. Dissert. Abstr.

**N73-33801** California Inst. of Tech., Pasadena.
**THE SUBSURFACE NATURE OF MERCURY AND MARS FROM THERMAL MICROWAVE EMISSION Ph.D. Thesis**
Jeffrey Nicholas Cuzzi 1973 184 p
Avail: Univ. Microfilms Order No. 73-18368

Detailed numerical modeling techniques are applied to the analysis of microwave observations of Mercury and Mars. The model calculations include the effects of orbital-axial resonance and dependence of regolith properties on temperature in the case of Mercury, and for the effects of seasonally varying CO2 frost crops in the case of Mars. Variations of geocentric aspect from one observation period to the next are treated for both planets. The dielectric properties of the subsurfaces of these planets are treated as independent of temperature and homogeneous with depth and location on the planet. Dissert. Abstr.

**N73-33802*#** Chicago Univ., Ill.
**POST-MISSION DATA ANALYSIS OF SURVEYOR MISSION CHEMICAL DATA Final Technical Report**
Anthony Turkevich Aug. 1973 13 p refs
(Grant NGR-14-001-128)
(NASA-CR-135900) Avail: NTIS HC $3.00 CSCL 03B

Prime data from chemical analysis experiments, of Surveyor 5, 6, and 7 are critically examined and analyzed. This and associated laboratory work has given final chemical composition results for the lunar regolith at three locations. The conclusions made on the basis of the preliminary examinations of the data are confirmed and extended. Author

**N73-33803*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**SKYLAB: A GUIDEBOOK**
Leland F. Belew and Ernst Stuhlinger 1973 253 p refs
(NASA-EP-107) Avail: NTIS MF $1.45; SOD HC $2.10 Domestic Postpaid or $1.75 GPO Bookstore CSCL 22A

A description of the history and development of the Skylab program is presented. Mission objectives, launch preparations, and crew activities and training program are outlined. Skylab design and operation are presented, and research programs on Skylab are described along with ground-based supporting projects. K.M.M.

**N73-33804*#** National Aeronautics and Space Administration, Washington, D.C.
**APOLLO 17: AT TAURUS LITTROW**
David A. Anderton 1973 33 p Original contains color illustrations
(NASA-EP-102) Avail: NTIS MF $1.45; SOD HC $1.25 CSCL 22C

A summation, with color illustrations, is presented on the Apollo 17 mission. The height, weight, and thrust specifications are given on the launch vehicle. Presentations are given on: the night launch; earth to moon ascent; separation and descent; EVA, the sixth lunar surface expedition; ascent from Taurus-Littrow; the America to Challenger rendezvous; return, reentry, and recovery; the scientific results of the mission; background information on the astronauts; and the future projects. T.M.R.

**N73-33805*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE 15TH ORDER RESONANCE ON THE DECAYING ORBIT OF TETR-3**
C. A. Wagner and S. M. Klosko (Wolf Res. and Develop. Corp., Riverdale, Md.) Sep. 1973 34 p refs
(NASA-TM-X-70484; X-592-73-279) Avail: NTIS HC $3.75 CSCL 22C

The orbit of TETR-3 (1971-83B), inclination: 33 deg, passed through resonance with 15th order geopotential terms in February 1972. The resonance caused the orbit inclination to increase by 0.015 deg. Analysis of 48 sets of mean Kepler elements for this satellite in 1971-1972 (across the resonance) has established strong constraints for high degree, 15th order gravitational terms (normalized). This result combined with previous results on high inclination 15th order and other resonant orbits suggests that the coefficients of the gravity field beyond the 16th degree are significantly smaller than Kaula's rule. Author

**N73-33806*#** Linguistic Systems, Inc., Cambridge, Mass.
**THE TEMPERATURE OF PLANETS**
K. Ye. Tsiolkovskiy Washington NASA Oct. 1973 12 p Transl. into ENGLISH of the book "Sobraniye Sochineniy. Vol. 4: Estestvozn. Tekhn." Moscow, Nauka Press, 1964 p 97-102
(Contract NASw-2482)
(NASA-TT-F-15040) Avail: NTIS HC $3.00 CSCL 03B

The factors affecting the temperature of a solid or oceanic surface of a planet and the adjacent layers of the atmosphere are discussed. The relation between the temperature of a planet and the types of organic life forming on it is pointed out. It is shown that the temperature decrease with increasing height of the atmosphere is proportional to the force of gravity and inversely proportional to the specific heat of the gas. It is found that the greater the height and the transparency of the atmosphere and the blacker the soil of the planet, the greater the temperature of the lower layers of the atmosphere. Author

**N73-33807*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**NATURAL ENVIRONMENTAL CRITERIA FOR THE NASA HIGH ENERGY ASTRONOMY OBSERVATORY (HEAO)**
Lewis E. Andrews 19 Sep. 1973 24 p refs
(NASA-TM-X-64784) Avail: NTIS HC $3.25 CSCL 22A

Environment criteria are presented for the High Energy Astronomy Observatory Program. Information in selected disciplinary areas is given for the region of space that is within 1000 km from the earth's surface. Author

**N73-33808*#** Scripta Technica, Inc., Washington, D.C.
**A POSSIBLE INTERPRETATION OF THE DISTRIBUTION OF CRATERS ON THE SURFACE OF THE MOON**
Yu. G. Malama NASA Oct. 1973 18 p refs Transl. into ENGLISH of "Vozmozhnaya Intepretasiya Raspredeleniya Kraterov na Poverkhnosti Luny", Acad. of Sci. USSR, Inst. of Space Res., Moscow, report Pr-132, 1973 p 3-21
(Contract NASw-2484)
(NASA-TT-F-15122; Pr-132) Avail: NTIS HC $3.00 CSCL 03B

Assuming that the processes of formation and destruction of craters are the consequence of the impact of meteorites on the surface of the moon, an attempt is made to interpret available data on the distribution of craters. Expressions are derived for the lifetime of the craters and the distributions of their diameters and volumes. These agree well with distributions in the lunar maria, given reasonable values for the parameters. Data on the distribution of craters in the lunar continents are discussed. A pattern of events involving two strings of meteorites is proposed which qualitatively explains the actual distributions. It is concluded that parameters of meteorite flow varied significantly over a period of about 4.5 x 10 to the 9th power years, while the total mass of meteorites falling in unit time on a unit of area declined over a period of about 4 x 10 to the 9th power years by at least 10 times. Author

**N73-33809*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**TRAJECTORIES OF EXPLORERS 33, 35, 41, 43 AND 47, MAY 1969 - DEC. 1972**
D. H. Fairfield, K. W. Behannon, R. P. Lepping, and N. F. Ness Oct. 1973 72 p refs
(NASA-TM-X-70481; X-692-73-291) Avail: NTIS HC $5.75 CSCL 22C

Magnetic field data from magnetometer experiments on Explorers 33, 35, 41, 43, and 47 are presented. Solar ecliptic plane projections of the orbits of the five satellites are included along with nominal positions of the magnetopause and bow shock. K.M.M.

**N73-33810#** Illinois Univ., Urbana. Aeronomy Lab.
**A CALCULATION OF THE LUNAR DIURNAL ATMOSPHERIC TIDE**
Marvin A. Geller and Mark R. Schoeberl [1973] 25 p refs Submitted for publication
(Grant NSF GA-25660)
Avail: NTIS HC $3.25

Classical tidal calculations are made for the atmospheric response to the lunar diurnal component of the moon's gravitational forcing (period equal to 25.82 mean solar hours). The calculated amplitudes for the lunar diurnal oscillation in surface pressure agree with the observations of Malin and Chapman except at Hong Kong where ocean tidal effects appear to be dominant. Calculations of the lunar diurnal wind oscillation at the ground and at 100 km are also made. Author

**N73-33811*#** National Aeronautics and Space Administration, Washington, D.C.
**SKYLAB EXPERIMENTS. VOLUME 1: PHYSICAL SCIENCE, SOLAR ASTRONOMY**
May 1973 74 p refs Prepared in cooperation with Colo. Univ.
(NASA-EP-110) Avail: NTIS MF $1.45; SOD HC $1.25 CSCL 22C

The basic subject of this volume is the solar astronomy program conducted on Skylab. In addition to descriptions of the individual experiments and the principles involved in their performance, a brief description is included of the sun and the energy characteristics associated with each zone. Wherever possible, related classroom activities have been identified and discussed in some detail. It will be apparent that the relationships rest not only in the field of solar astronomy, but also in the following subjects: (1) physics - optics, electromagnetic spectrum, atomic structure, etc.; (2) chemistry - emission spectra, kinetic theory, X-ray absorption, etc.; (3) biology - radiation and dependence on the sun; (4) electronics - cathode ray tubes, detectors, photomultipliers, etc.; (5) photography; (6) astronomy; and (7) industrial arts. Author

**N73-33812*#** National Aeronautics and Space Administration, Washington, D.C.
**SKYLAB EXPERIMENTS. VOLUME 2: REMOTE SENSING OF EARTH RESOURCES**
May 1973 89 p refs Prepared in cooperation with Colo. Univ.
(NASA-EP-111) Avail: NTIS MF $1.45; SOD HC $1.25 CSCL 22C

This volume covers the broad area of earth resources in which Skylab experiments will be performed. A brief description of the Skylab program, its objectives, and vehicles is included. Section 1 introduces the concept and historical significance of remote sensing, and discusses the major scientific considerations involved in remotely sensing the earth's resources. Sections 2 through 6 provide a description of the individual earth resource sensors and experiments to be performed. Each description includes a discussion of the experiment background and scientific objectives, the equipment involved, and a discussion of significant experiment performance areas. Author

**N73-33813*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**APOLLO/SOYUZ TEST PROJECT OPERATIONAL DATA BOOK. VOLUME 2: ASTP MASS PROPERTIES DATA BOOK**
Feb. 1973 136 p refs
(NASA-TM-X-69502; MSC-07765-Vol-2) Avail: NTIS HC $9.00 CSCL 22A

Spacecraft mass properties data are provided for use in mission planning, trajectory documentation, mission simulations, and consumable loading. Spacecraft for use in determining locations of spacecraft components and the relationship to coordinate systems in the launch and docked configuration. Mass properties and consumable loading data for the ASTP mission are included along with consumables mass property data and mission independent consumable loading information for the CSM and DM. Author

**N73-33814*#** Kanner (Leo) Associates, Redwood City, Calif.
**OBSERVATIONS FROM SPACE OF NIGHT-SKY BRIGHTNESS FROM THE KOSMOS-51 AND KOSMOS-213 SATELLITES. 2: RESULTS AND DISCUSSION**
N. A. Dimov, A. M. Zvereva, and A. B. Severnyy Washington NASA Oct. 1973 40 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Obs. (Moscow), v. 45 1972 p 67-89
(Contract NASw-2481)
(NASA-TT-F-15154) Avail: NTIS HC $4.00 CSCL 03B

The night-sky brightness in the visible and the ultraviolet spectral regions was measured with photometers installed on the Kosmos-51 and the Kosmos-213 satellites. Telemetry data made it possible to estimate the observed ratio of fluxes in the ultraviolet and visible regions and also the nightsky brightness (in the number of stars per square degree). These values are compared with the expected ratio and with the value calculated from data on the number and brightness of stars and the theoretical flux ratios for stars in various spectral classes. Author

**N73-33815*#** Kanner (Leo) Associates, Redwood City, Calif.
**OBSERVATIONS FROM SPACE OF NIGHT-SKY BRIGHTNESS FROM THE KOSMOS-51 AND KOSMOS-213 SATELLITES. 1: METHOD AND CALIBRATION OF THE MEASUREMENTS**
N. A. Dimov and A. B. Severnyy Washington NASA Oct. 1973 27 p refs Transl. into ENGLSIH from Izv. Krymsk. Astrofiz. Obs. (Moscow), v. 45, 1972 p 53-66
(Contract NASw-2481)
(NASA-TT-F-15153) Avail: NTIS HC $3.50 CSCL 03B

Descriptions are given of wide-angle photometers for simultaneous recording in space of the night-sky brightness in the ultraviolet and in the visible spectral regions. Also provided are the recordings of the dark current and the brightness of the phosphor. The photomultipliers and the electronic circuit are described. The ratio of the maximum sensitivity of the ultraviolet and visible channels, was determined for the photometer installed on Kosmos-51. Author

**N73-33816*#** Linguistic Systems, Inc., Cambridge, Mass.
**ON THE APPROACHES OF GLOBAL METALLOGENY**
Marina Alekseyevna Favorskaya Washington NASA Oct. 1973 22 p refs Transl. into ENGLISH from Priroda (Moscow), no. 3, Mar. 1973 p 2-9
(Contract NASw-2482)
(NASA-TT-F-15098) Avail: NTIS HC $3.25 CSCL 03B

The development is presented of metallogeny, the science of the distribution of ore deposits. Consideration is given to ocean metallogeny as it bears on global metallogeny, with the assessing of possible links between continental fault systems and ocean fault systems, and with consideration of geologic anomalies and periods of increased activity of the earth's deep zones. Global metallogeny and the theories of earth's deep zones. Global metallogeny and the theories of mobalism are discussed. The expansion from global metallogeny to global minerallogeny is reviewed. Author

**N73-33817*#** Linguistic Systems, Inc., Cambridge, Mass.
**THE NATURAL EXOELECTRON EMISSION OF THE ANORTHOSITE ROCKS DELIVERED BY AUTOMATIC INTERPLANETARY STATION LUNA-20**
R. I. Mints, I. I. Milman, V. I. Kryuk, and L. S. Tarasov Washington NASA Oct. 1973 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 209, no. 3, 1973 p 586-588
(Contract NASw-2482)
(NASA-TT-F-15116) Avail: NTIS HC $3.00 CSCL 03B

Experiments are described that were performed on two groups of feldspar samples that were recovered by the Luna-20. One group was clear in appearance, the other was cloudy. Samples from each group were linearly heated up in a vacuum and the exoemission of the electrons were recorded in order to determine the structural imperfections and the thermal prehistory of each of the samples. Author

**N73-33818*#** Linguistic Systems, Inc., Cambridge, Mass.
**THE UTILIZATION OF EXTRA-ATMOSPHERIC SPACE**
Alexandre Kiss Washington NASA Oct. 1973 13 p refs Transl. into ENGLISH from Rech. Spatiale (Paris), v. 12, no. 2, Mar. - Apr. 1973 p 5-9

(Contract NASw-2482)
(NASA-TT-F-15118) Avail: NTIS HC $3.00 CSCL 22A

The utilization of extra-atmospheric space is examined in the light of three international agreements relating to the currently developing need for regulation of use of space. The limits of extra-atmospheric space are considered. The definition of space activities is assessed with a consideration of the terms exploration and utilization as used by several precedential examples of space law. Author

**N73-33819*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**SATURN 5 LAUNCH VEHICLE FLIGHT EVALUATION REPORT, AS-510, APOLLO 15 MISSION**
28 Oct. 1971 312 p refs
(NASA-TM-X-69539; MPR-SAT-FE-71-2) Avail: NTIS HC $17.75 CSCL 22C

A postflight analysis of the Apollo 15 flight is presented. The performance of the launch vehicle, spacecraft, and lunar roving vehicle are discussed. The objective of the evaluation is to acquire, reduce, analyze, and report on flight data to the extent required to assure future mission success and vehicle reliability. Actual flight problems are identified, their causes are determined, and recommendations are made for corrective actions. Summaries of launch operations and spacecraft performance are included. Significant events for all phases of the flight are tabulated. Author

**N73-33820*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**SATURN 1B LAUNCH VEHICLE FLIGHT EVALUATION REPORT, SA-206, SKYLAB-2**
23 Jul. 1973 230 p refs
(NASA-TM-X-69538; MPR-SAT-FE-73-3) Avail: NTIS HC $13.50 CSCL 22C

The performance evaluation of the SA-206 launch vehicle for the Skylab 2 launch is presented. Flight problems are identified, the causes are determined, and recommendations are made for appropriate corrective action. Summaries of launch operations and spacecraft performance are included. The significant events, failures, and anomalies are tabulated. Author

**N73-33821*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**SATURN 1B LAUNCH VEHICLE FLIGHT EVALUATION REPORT-SA-207: SKYLAB-3**
8 Oct. 1973 234 p
(NASA-TM-X-69540; MPR-SAT-FE-73-5) Avail: NTIS HC $13.75 CSCL 22C

The performance evaluation of the SA-207 launch vehicle for the Skylab 3 launch is presented. Flight problems are identified, the causes are determined, and recommendations are made for appropriate corrective action. Summaries of launch operations and spacecraft performance are included. The significant events, failures, and anomalies are tabulated. Author

**N73-33822*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**SATURN 5 LAUNCH VEHICLE FLIGHT EVALUATION REPORT-AS-512 APOLLO 17 MISSION**
28 Feb. 1973 295 p
(NASA-TM-X-69534; MPR-SAT-FE-73-1) Avail: NTIS HC $16.75 CSCL 22C

An evaluation of the launch vehicle and lunar roving vehicle performance for the Apollo 17 flight is presented. The objective of the evaluation is to acquire, reduce, analyze, and report on flight data to the extent required to assure future mission success and vehicle reliability. Actual flight problems are identified, their causes are determined, and recommendations are made for corrective action. Summaries of launch operations and spacecraft performance are included. The significant events for all phases of the flight are analyzed. Author

**N73-33823*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**SATURN 5 LAUNCH VEHICLE FLIGHT EVALUATION REPORT-AS-511 APOLLO 16 MISSION**
19 Jun. 1972 317 p
(NASA-TM-X-69535; MPR-SAT-FE-72-1) Avail: NTIS HC $18.00 CSCL 22C

A postflight analysis of the Apollo 16 mission is presented. The basic objective of the flight evaluation is to acquire, reduce, analyze, and report on flight data to the extent required to assure future mission success and vehicle reliability. Actual flight problems are identified, their causes are determined, and recommendations are made for corrective actions. Summaries of launch operations and spacecraft performance are included. Significant events for all phases of the flight are provide in tabular form. Author

**N73-33824*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**SATURN 5 LAUNCH VEHICLE FLIGHT EVALUATION REPORT-AS-509 APOLLO 14 MISSION**
1 Apr. 1971 253 p
(NASA-TM-X-69536; MPR-SAT-FE-71-1) Avail: NTIS HC $14.75 CSCL 22C

A postflight analysis of the Apollo 14 flight is presented. The basic objective of the flight evaluation is to acquire, reduce, analyze, and report on flight data to the extent required to assure future mission success and vehicle reliability. Actual flight failures are identified, their causes are determined and corrective actions are recommended. Summaries of launch operations and spacecraft performance are included. The significant events for all phases of the flight are analyzed. Author

**N73-33825*#** Linguistic Systems, Inc., Cambridge, Mass.
**PERTURBATION OF A NEARLY-CIRCULAR ORBIT**
Ye. I. Timoshkova and K. V. Kholshevnikov Washington NASA Nov. 1973 19 p refs Transl. into ENGLISH from Tr. Astron. Observ. (Leningrad), v. 29, 1973 p 163-176
(Contract NASw-2482)
(NASA-TT-F-15073) Avail: NTIS HC $3.00 CSCL 22C

The satellite motion in a gravitational field of a nonspherical rotating planet is considered. The motion in the field of two fixed centers is taken as the unperturbed one. The Lagrange-type equations are derived for the perturbed elements of the intermediate nearly-circular orbit. The integration of these equations is fulfilled and the expressions are given for the calculation of the secular, long-period and short-period perturbations caused by an arbitrary harmonics of the planet's potential. Author

**N73-33826#** Oslo Univ. (Norway). Inst. for Teoretisk Astrofysikk.
**ISOTOPIC COMPOSITION OF SOME METALS IN THE SUN**
Oe. Hauge 1972 76 p refs
(Grant AF-AFOSR-2294-72)
(NP-19727) Avail: AEC Depository Libraries $6.00

Information on the isotopic composition of chemical elements in the sun may be obtained by analysis of photospheric and sunspot spectra. It is shown that besides investigations performed on molecular lines, information on isotope abundances of some heavier elements may also be derived from atomic line studies. A discussion of the elements Rb, Sr, Sb, and Eu are described. Studies of the solar isotopic composition of Cu from analysis of Cu I lines in photospheric spectra and CuH lines in sunspot spectra are described. The investigations provide no proof of nonterrestrial isotope ratios in the Sun of any of the elements listed. The abundances of Rb, Sr, and Eu were determined and the results agree closely with previously determined values. Author (NSA)

**N73-33827#** California Inst. of Tech., Pasadena. George W. Downs Lab. of Physics.
**INFRARED PHOTOMETRY OF BRIGHT CELESTIAL SOURCES Final Report, Dec. 1969 - Dec. 1972**
Gerry Neugebauer Jan. 1973 36 p
(Contract F19628-70-C-0127; AF Proj. 7670)
(AD-764686; AFCRL-TR-73-0114) Avail: NTIS CSCL 03/2

The primary purpose of the contract was to see if it was worthwhile to use the 62-inch telescope on Mt. Wilson for either a 5 or 10 micrometers survey. It was found that the sensitivity of a system using the 62-inch telescope was too low in comparison with that of the AFCRL rocket survey to justify a complete ground based sky survey. During the second and third years a

systematic project of observing over a dozen bright 10 micrometers sources was followed to understand how they vary and what the mechanism for their emission processes is. After the AFCRL survey was completed those sources which have been identified with IRC sources were looked at selectively. Author (GRA)

**N73-33828#** Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
**ORBIT DETERMINATION IN THE PRESENCE OF GRAVITY MODEL ERRORS Interim Report**
B. E. Schutz, B. D. Tapley, and P. E. Connolly Aug. 1972 42 p refs Presented at Symp. on Earth Gravity Models, St. Louis, 16-18 Aug. 1972
(Grant AF-AFOSR-2233-72; AF Proj. 9769)
(AD-765551; AFOSR-73-1439TR) Avail: NTIS CSCL 22/3

The precise determination of a satellite's position is of prime importance in satellite geodesy and in the use of satellites in studying geodynamics. It is not possible, however, to obtain a precise estimate of the satellite's position if sufficiently large errors exist in the gravity model. In this investigation, the application of a dynamic model compensation method to the problem of estimating the motion of a near-earth satellite in the presence of gravity model errors is described. Based on numerical results obtained in a computer simulation, it is concluded that the algorithm will yield an accurate estimate of the state in the presence of gravity model errors. The effects of the observation type and accuracy, station location and observation batch size on the accuracy of the orbit determination procedure are considered. Finally, it is shown that in addition to an accurate estimate of the position and velocity, the method can be used to obtain an accurate estimate of the unmodeled acceleration components. Author (GRA)

**N73-33835*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**PROJECT OBJECTIVES AND MISSION PROFILE**
R. H. Steinbacher and A. B. Whitehead *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 1-11 refs (For availability see N73-33834 24-31)
CSCL 22A

**N73-33836*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**CELESTIAL MECHANICS EXPERIMENT**
J. Lorell, J. D. Anderson, J. F. Jordan, R. D. Reasenberg (MIT, Cambridge), and I. I. Shapiro (MIT, Cambridge) *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 13-31 refs (For availability see N73-33834 24-31)
CSCL 03C

**N73-33837*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**S-BAND OCCULTATION EXPERIMENT: A SUMMARY**
A. J. Kliore, D. L. Cain, G. Fjeldbo, B. L. Seidel, M. J. Sykes, P. M. Woiceshyn, and S. I Rasool (NASA, Washington, D. C.) *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 33-36 refs Prepared in cooperation with NASA, Washington, D. C. (For availability see N73-33834 24-31)
CSCL 03B

**N73-33838*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**INFRARED RADIOMETRY EXPERIMENT**
S. C. Chase (Santa Barbara Res. Center, Goleta, Calif.), H. H. Kieffer (Calif. Univ., Los Angeles), E. Miner, G. Muench (Calif. Inst. of Tech., Pasadena), and G. Neugebauer (Calif. Inst. of Tech., Pasadena) *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 37-40 ref (For availability see N73-33834 24-31)
CSCL 03B

**N73-33839*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**INFRARED SPECTROSCOPY EXPERIMENT: AN OVERVIEW**
R. Hanel, B. Conrath, R. Curran, W. Hovis, V. Kunde, P. Lowman, W. Maguire, J. Pearl, J. Pirraglia, C. Prabhakara et al *In* JPL Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 41-52 refs Prepared in cooperation with Biospherics, Inc. and JPL (For availability see N73-33834 24-31)
CSCL 03B

**N73-33842*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**SURFACE PROPERTIES WORKING GROUP**
A. B. Whitehead and D. L. Cain *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 81-85 refs (For availability see N73-33834 24-31)
CSCL 14B

**N73-33843*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**VOLATILES WORKING GROUP**
James A. Cutts *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 87-97 refs (For availability see N73-33834 24-31)
CSCL 03B

**N73-33844*** Washington Univ., Seattle. Dept. of Atmospheric Sciences.
**ATMOSPHERIC PHENOMENA WORKING GROUP**
Conway B. Leovy *In* JPL Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 99-104 refs (For availability see N73-33834 24-31)
CSCL 03B

# 31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

**N73-33829*#** Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
**ALTERNATE CONCEPTS STUDY EXTENSION. VOLUME 2: PART 4: AVIONICS Final Report**
6 Dec. 1971 319 p refs
(Contract NAS8-26362)
(NASA-CR-124344; LMSC-A995931-Vol-2-Pt-4) Avail: NTIS HC $18.00 CSCL 22B

A recommended baseline system is presented along with alternate avionics systems, Mark 2 avionics, booster avionics, and a cost summary. Analyses and discussions are included on the Mark 1 orbiter avionics subsystems, electrical ground support equipment, and the computer programs. Results indicate a need to define all subsystems of the baseline system, an installation study to determine the impact on the crew station, and a study on access for maintenance. T.M.R.

**N73-33830*#** URS/Matrix Co., Huntsville, Ala.
**DEVELOPMENT OF FLIGHT EXPERIMENT WORK PERFORMANCE AND WORKSTATION INTERFACE REQUIREMENTS. PART 2: APPENDIX H Final Report**
Richard G. Hatterick 31 Aug. 1973 288 p
(Contract NAS8-28359)
(NASA-CR-124452; PRL-415-Pt-2) Avail: NTIS HC $16.50 CSCL 22B

A skill requirement definition method was applied to the problem of determining, at an early stage in system/mission definition, the skills required of on-orbit crew personnel whose activities will be related to the conduct or support of earth-orbital research. The experiment data base was selected from proposed experiments in NASA's Earth Orbital Research and Application Investigation program as related to space shuttle missions, specifically those being considered for sortie lab. Activities during the study, include indentification of basic functions dealing with man's research and/or servicing activities on orbit. A crew function taxonomy was prepared relative to these activities. Likely candidate experiments for shuttle sortie missions were selected through extensive review of experiment and mission descriptions. Crew functions and tasks were initially identified for more than fifty representative earth orbital experiments, and a comprehensive task analysis was conducted on these tasks for selected payloads. Author

**N73-33831*#** Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
**DYNAMICS AND CONTROL OF DETUMBLING A DISABLED SPACECRAFT DURING RESCUE OPERATIONS Summary Final Report**
Marshall H. Kaplan Sep. 1973 29 p refs
(Grant NGR-39-009-210)
(NASA-CR-135788; AAR-73-10) Avail: NTIS HC $3.50 CSCL 22B

Results of a two-year research effort on dynamics and control of detumbling a disabled spacecraft during rescue operations are summarized. Answers to several basic questions about associated techniques and hardware requirements were obtained. Specifically, efforts have included development of operational procedures, conceptual design of remotely controlled modules, feasibility of internal moving mass for stabilization, and optimal techniques for minimum-time detumbling. Results have been documented in several reports and publications. Author

**N73-33832*#** Martin Marietta Corp., Denver, Colo.
**UNIVERSAL STOWAGE MODULE FOR FUTURE SPACE EXPLORATION Interim Report**
Victor A. SecCamp, Michael W. Hussex, Paul Garber, William Mandras, and Don McKinney Oct. 1973 38 p
(Contract NAS8-29777)
(NASA-CR-124465; MCR-73-286) Avail: NTIS HC $4.00 CSCL 22B

The development, design, and fabrication of a prototype storage module, with internal restraints, for the stowage of items that are normally launched to support a space mission are discussed. The primary design criteria was that the storage module be universal in accomodating most sizes and shapes of items that could be launched and returned in a shuttle payload. Mechanical drawings of various types of storage modules are provided. Author

**N73-33833*#** Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
**DOD/NASA SYSTEM IMPACT ANALYSIS (STUDY 2.1). VOLUME 2: STUDY RESULTS**
15 Sep. 1973 159 p refs
(Contract NASw-2472)
(NASA-CR-135765; ATR-74(7331)-1-Vol-2) Avail: NTIS HC $10.00 CSCL 22B

Results of the tug turnaround cost study and the space transportation system (STS) abort modes and effects study are presented for DOD/NASA system impact analysis. Cost estimates are given for tug turnabout; and vehicle description, abort assessment, and abort performance capability are given for the STS. K.M.M.

**N73-33834*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**MARINER MARS 1971 PROJECT. VOLUME 5: SCIENCE EXPERIMENT REPORTS Final Report**
20 Aug. 1973 106 p refs
(Contract NAS7-100)
(NASA-CR-135726; JPL-TR-32-1550-Vol-5) Avail: NTIS HC $7.50 CSCL 22B

The scientific objective of each experiment on Mariner 9, as originally planned; the results derived from 18 months of data analysis; and the degree to which these objectives were met are reported. For individual titles, see N73-33835 through N73-33844.

**N73-33835*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**PROJECT OBJECTIVES AND MISSION PROFILE c30**
R. H. Steinbacher and A. B. Whitehead *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 1-11 refs (For availability see N73-33834 24-31)
CSCL 22A

Mission planning, payloads, launch, and orbital insertion are described for Mariner mission 8 and 9. Mission sequences and planet coverage as a function of time in orbit are discussed. F.O.S.

**N73-33836*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**CELESTIAL MECHANICS EXPERIMENT c30**
J. Lorell, J. D. Anderson, J. F. Jordan, R. D. Reasenberg (MIT, Cambridge), and I. I. Shapiro (MIT, Cambridge) *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 13-31 refs (For availability see N73-33834 24-31)
CSCL 03C

The efforts and accomplishments of the CME Team are summarized. The objectives and experiment status, gravity field of Mars, test of general relativity, and the generation of normal points are discussed. F.O.S.

**N73-33837*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**S-BAND OCCULTATION EXPERIMENT: A SUMMARY c30**
A. J. Kliore, D. L. Cain, G. Fjeldbo, B. L. Seidel, M. J. Sykes, P. M. Woiceshyn, and S. I Rasool (NASA, Washington, D. C.) *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 33-36 refs Prepared in cooperation with NASA, Washington, D. C. (For availability see N73-33834 24-31)
CSCL 03B

The objectives and requirements of the experiment are described. The Martian atmosphere and ionosphere, and the radius and shape of Mars are discussed. F.O.S.

**N73-33838*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**INFRARED RADIOMETRY EXPERIMENT c30**
S. C. Chase (Santa Barbara Res. Center, Goleta, Calif.), H. H. Kieffer (Calif. Univ., Los Angeles), E. Miner, G. Muench (Calif. Inst. of Tech., Pasadena), and G. Neugebauer (Calif. Inst. of Tech., Pasadena) *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 37-40 ref (For availability see N73-33834 24-31)
CSCL 03B

The objectives of the experiment are discussed. These objectives were: (1) measure the thermophysical properties of the Martian surface on a global scale; (2) isolate large-scale irregularities in the global picture; and (3) isolate small-scale hot or cold spots on the surface. Author

**N73-33839*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**INFRARED SPECTROSCOPY EXPERIMENT: AN OVERVIEW c30**
R. Hanel, B. Conrath, R. Curran, W. Hovis, V. Kunde, P. Lowman, W. Maguire, J. Pearl, J. Pirraglia, C. Prabhakara et al *In* JPL Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 41-52 refs Prepared in cooperation with Biospherics, Inc. and JPL (For availability see N73-33834 24-31)
CSCL 03B

A retrospective look at the operation and results of the experiment is presented. The design and performance of the infrared interferometer spectrometer are discussed along with the results obtained concerning the atmospheric and surface properties. F.O.S.

**N73-33840*** Colorado Univ., Boulder.
**ULTRAVIOLET SPECTROMETER EXPERIMENT c14**
C. A. Barth, C. W. Hord, A. I. Stewart, and A. L. Lane (JPL) *In* JPL Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 53-61 refs (For availability see N73-33834 24-31)
CSCL 14B

The original scientific objectives and the achieved results are discussed. The upper atmosphere was found to have a variable temperature, with a mean exospheric temperature of 325 K; composed predominantley of CO2. Measurements of hydrogen and ozone are analyzed. F.O.S.

**N73-33841*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**TELEVISION EXPERIMENT c07**
G. A. Briggs, J. A. Cutts, R. H. Steinbacher, T. E. Thorpe, A. B. Whitehead, G. DeVaucouleurs (Tex. Univ., Austin), M. E. Davies (Rand Corp., Santa Monica, Calif.), H. Masursky (Geological Survey, Flagstaff, Ariz.), and J. B. Pollack (NASA. Ames Res. Center) *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 63-70

refs Prepared in cooperation with NASA. Ames Res. Center (For availability see N73-33834 24-31)
CSCL 09F

The fixed and variable Martian features investigated by the TV experiment on Mariner 9 are described. Articles are presented concerning the dust storm of October to November over the Southern Hemisphere; global surface geodesy and cartography; geology; and the satellite astronomy. F.O.S.

**N73-33842*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**SURFACE PROPERTIES WORKING GROUP** c30
A. B. Whitehead and D. L. Cain *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 81-85 refs (For availability see N73-33834 24-31)
CSCL 14B

The objectives of the Mars surface properties working group are described. The objectives were: (1) determine a simple reference surface that would adequately represent the shape of the planet for cartographic purposes; (2) monitor the topographic results and to assess the relative calibration and accuracies of these techniques, thereby leading to a composite topographic map of the planet; and (3) facilitate the exchange of data in closely connected disciplines. The shape, topography, and isobaric surface are discussed along with the gravity field, and crustal density model. It was found that there is no simple reference figure for the planetary surface, although an offset, triaxial ellipsoid is adequate for most purposes. F.O.S.

**N73-33843*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**VOLATILES WORKING GROUP** c30
James A. Cutts *In its* Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 87-97 refs (For availability see N73-33834 24-31)
CSCL 03B

The physical behavior of water and carbon dioxide on Mars was studied. Topics discussed include: physics of polar frosts, CO2 budget, atmospheric minor constituents, chemical and physical properties of surface materials, layered deposits, and the role of volatiles in the Martian landscape formation. F.O.S.

**N73-33844*** Washington Univ., Seattle. Dept. of Atmospheric Sciences.
**ATMOSPHERIC PHENOMENA WORKING GROUP** c30
Conway B. Leovy *In* JPL Mariner Mars 1971 Proj., Vol. 5 20 Aug. 1973 p 99-104 refs (For availability see N73-33834 24-31)
CSCL 03B

Atmospheric processes on Mars are reported based on atmospheric observations from Mariner 9. Topics discussed include: atmospheric temperature and wind, cloud processes, minor constituents, global dust storm, and surface pressure distribution. F.O.S.

**N73-33845*#** Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
**CANDIDATE CONFIGURATION TRADE STUDY, STELLAR-INERTIAL MEASUREMENT SYSTEM (SIMS) FOR AN EARTH OBSERVATION SATELLITE (EOS), ADDENDUM**
Robert White and Fred Grant 30 Jun. 1973 95 p refs
(Contract NAS9-4065)
(NASA-CR-134042; R-741-Add) Avail: NTIS HC $6.75 CSCL 22B

Results are given of an investigation of the effects of spacecraft orbital ephemeris and attitude errors on the ability to determine the locations of unknown landmarks with respect to known landmarks in the payload sensor imagery. Author

**N73-33846*#** National Aeronautics and Space Administration, Washington, D.C.
**SPACE SHUTTLE: EMPHASIS FOR THE 1970'S**
Jun. 1972 10 p Original contains color illustrations
(NASA-EP-96) Avail: NTIS MF $1.45; SOD HC $0.40 CSCL 22B

The space shuttle is described as a vehicle which combines the advantages of airplanes and spacecraft, capable of repeatedly flying to space and back to earth. It will takeoff vertically, powered by two solid propellant boosters, which will be parachuted to earth at an altitude of about 40 km, for retrieval. New uses of space flight are anticipated as costs decrease, turn-around times shorten, and operations simplified. Color illustrations of the concepts are included. F.O.S.

**N73-33847*#** Chrysler Corp., New Orleans, La. Space Div.
**THE DEVELOPMENT OF A PSEUDO-NYQUIST ANALYSIS TECHNIQUE FOR HYBRID SAMPLED-DATA CONTROL SYSTEMS**
Milford G. Burnitt and Charles W. Davis Washington NASA Oct. 1973 43 p refs
(Contract NAS8-4016)
(NASA-CR-2345) Avail: NTIS HC $3.00 CSCL 22B

The stability characteristics of a launch vehicle, as a function of gain and phase variations at the thrust vector controller, cannot be obtained using classical sampled-data control theory if the launch vehicle attitude control system contains both sampled-data and continuous feedback control loops. A method was developed which can be used to generate a sampled-data pseudo-Nyquist plot for gain and phase variations at the controller. This method was developed and used to determine the stability characteristics of the Saturn 1B launch vehicle in the backup guidance mode. Author

**N73-33848*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**SATURN 5 LAUNCH VEHICLE FLIGHT EVALUATION REPORT, SA-513, SKYLAB 1**
1 Aug. 1973 255 p refs
(NASA-TM-X-69537; MPR-SAT-FE-73-4) Avail: NTIS HC $14.75 CSCL 22B

Saturn V SA-513 (Skylab-1) was launched at 13:30:00 Eastern Daylight Time (EDT) on May 14, 1973, from Kennedy Space Center, Complex 39, Pad A. The vehicle lifted off on a launch azimuth of 90 degrees east of north and rolled to a flight azimuth of 40.88 degrees east of north. The launch vehicle successfully placed the Saturn Work Shop in the planned earth orbit. All launch vehicle objectives were accomplished. No launch vehicle failures or anomalies occurred that seriously affected the mission. Author

**N73-33849*#** Cornell Univ., Ithaca, N.Y. Coll. of Engineering.
**A REUSABLE LUNAR SHUTTLECRAFT (RLS): A SYSTEMS STUDY**
Aug. 1973 185 p refs
(Grant NGR-33-010-071)
(NASA-CR-135794) Avail: NTIS HC $11.25 CSCL 22B

A study effort to conceive and design a reusable lunar space vehicle system was conducted at a university. The purpose of the program was to expose students to the problems faced by other disciplines in the design of a complete vehicle system. The subjects investigated are: (1) objectives, feasibility, and cost of reusable lunar shuttlecraft, (2) trajectory analysis, (3) guidance and navigation, (4) communication system, (5) propulsion system, (6) electrical power system, and (7) landing gear design. Author

**N73-33850*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**CENTAUR STANDARD SHROUD (CSS) CRYOGENIC UNLATCH TESTS**
Oct. 1973 269 p refs
(NASA-TM-X-71455) Avail: NTIS HC $15.50 CSCL 22B

Cryogenic tanking and partial jettison (unlatch) tests were performed on a full scale Centaur vehicle and Centaur Standard Shroud (CSS) to develop and qualify the CSS insulation system, the CSS and Centaur ground-hold purge systems, and the Centaur hydrogen tank flight vent system. Operation of the shroud/Centaur pyrotechnic systems, seals, and the shroud jettison springs, hinges, and other separation systems was demonstrated by a partial jettison of the shroud into catch nets. The Centaur tanks were filled with liquid hydrogen and liquid nitrogen. Prelaunch operations were performed, and data taken to establish system performances. Results from the initial tests showed a higher than expected heat transfer rate to the Centaur hydrogen tank. In addition, the release mechanism for the forward seal between the Centaur and the CSS did not function properly, and the seal was torn during jettison of the shroud. Author

**N73-33851*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**ANALYSES OF FLIGHT MODEL SPACECRAFT PERFORMANCE DURING THERMAL-VACUUM TESTS**
Albert R. Timmins, Robert E. Heuser, and James C. Strain Washington Nov. 1973 23 p refs
(NASA-TN-D-7408; G-7368) Avail: NTIS HC $2.75 CSCL 22B

Malfunction data from the thermal-vacuum tests of 39 flight-model spacecraft have been analyzed. The results are interpreted in terms of the test variables and the spacecraft performance. The malfunction data are correlated with the test time as a single variable, and also with the composite variable of time plus temperature. The improvement in spacecraft performance is examined by means of malfunction rates, malfunctions per spacecraft, and the probability of no failure related to test time. The minimum thermal-vacuum test profile required for Goddard Space Flight Center spacecraft is verified, and the probability of a defect remaining undetected is estimated. Author

**N73-33852#** Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
**INTRODUCTION TO SATELLITE DATA PROCESSING**
Bonn Bundesmin. fuer Forsch. und Technol. Feb. 1973 161 p refs Partly in ENGLISH and partly in GERMAN; ENGLISH summary Proc. of Seminar held in Lindau, West Ger., May 1972 Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-W-73-04) Avail: NTIS HC $10.25; ZLDI, Munich 35,45 DM

The procedures in satellite data processing from reception of the telemetry signal to plotting of the scientific results are presented, with particular reference to the Azur satellite. Two telemetry data systems, one based on real time and one on tape, are distinguished. These data were preprocessed to provide several output tape formats. The difficulties in time allocation on these tapes, resulting from onboard clock and world time deviations, were investigated. For individual titles, see N73-33853 through N73-33860.

**N73-33853** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Zentralabteilung Satellitenbetrieb.
**SATELLITE TELEMETRY [SATELLITENTELEMETRIE]**
K. Wiegand *In* Max-Planck-Inst. fuer Aeronomie Introduction to Satellite Data Process. Feb. 1973 p 9-25 ref In GERMAN (For availability see N73-33852 24-31)

The telemetry system of the Azur satellite is reported. Scientific and technical data were digitized onboard and transmitted to the ground stations serially in a fixed frame. The beginning of a cycle was marked by a synchronization word. The separate measured values can be reconstructed according to their position within the frame. Real time reception of all data was not possible due to the limited number of ground stations, but a tape recorder was used in addition for temporary data storage. Because of the limited storage capacity, a special tape telemetry system was introduced. The problem of world time allocation to the scientific data was solved with ground station clocks for real time telemetry, and with an onboard clock for the tape telemetry system. ESRO

**N73-33854** Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany). Datenzentrum.
**PREPROCESSING OF SATELLITE DATA [SATELLITENDATEN-VORVERARBEITUNG]**
F. W. Bertram *In* Max-Planck-Inst. fuer Aeronomie Introduction to Satellite Data Process. Feb. 1973 p 27-54 refs In GERMAN (For availability see N73-33852 24-31)

Azur satellite data were preprocessed to provide several output tape formats. The preprocessing phase embraces the first part of data processing from collection of the tape records of the ground stations (analog data) to the distribution of experimenter tapes. After data preparation, in order to convert the stream of binary signals drowned in noise to a computer compatible format, the resulting buffer tapes are processed in a large computer to produce assembly tapes. An edited tape is produced, using a special tape with orbital data for experimenters. Finally, the edited tapes are converted into documentation tapes for distribution to the experimenters. ESRO

**N73-33855** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Zentralabteilung Satellitenbetrieb.
**PROBLEMS OF TIME ALLOCATION IN AZUR SATELLITE [PROBLEME DER ZEITZUORDNUNG BEIM SATELLITEN AZUR]**
B. Ebel *In* Max-Planck-Inst. fuer Aeronomie Introduction to Satellite Data Process. Feb. 1973 p 55-75 ref In GERMAN (For availability see N73-33852 24-31)

The difficulties and methods in recognizing false time allocations in telemetry data recorded on magnetic tape, with regard to onboard clock and world time deviations are described. To determine the time of measurement, an onboard clock consisting of one or more counters controlled by a quartz crystal, and with no direct correlation to world time, was used. The correlation was established only after reception of the counter positions and addition of a code for world time. The problems involved in the exact allocation of world time are described, and a solution method, based on a check of the sequences of world time indications and of onboard clock counter positions, is proposed. ESRO

**N73-33856** Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
**SELECTION OF ADDITIONAL INFORMATION [AUSWAHL VON ZUSATZINFORMATIONEN]**
B. Theile *In* Max-Planck-Inst. fuer Aeronomie Introduction to Satellite Data Process. Feb. 1973 p 77-92 refs In GERMAN (For availability see N73-33852 24-31)

The selection of additional information from the Azur satellite for telemetry data processing purposes is discussed. The additional information covers timing data from onboard and ground clocks, orbital data from tracking stations, orbit program, orbit tape, position information from magnetometers and solar sensors, technical data from satellite housekeeping, data quality information from data preprocessing, organizational information, such as tape numbers, file numbers etc., and geophysical parameters. ESRO

**N73-33857** Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.
**REDUNDANCY ELIMINATION [REDUNDANZBESEITIGUNG]**
F. Singer (Tuebingen Univ.) and F. Both *In its* Introduction to Satellite Data Process. Feb. 1973 p 93-114 refs In GERMAN (For availability see N73-33852 24-31)

The elimination of redundancies and experience gained from this process, in Azur satellite telemetry data processing are reported. As a result of the large number of ground stations in the Azur project, identical data might possibly be collected by several stations. In order to eliminate the redundant data, two methods are proposed: sorting and mixing. In addition, a method is described for quality control and elimination of timing errors. The experience gained from redundancy elimination points out several error sources: errors originating from the analog phase of data extraction and processing, and errors from digitizing. These error sources are examined. ESRO

**N73-33858** Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
**ATTITUDE DETERMINATION [LAGEBESTIMMUNG]**
B. Theile *In* Max-Planck-Inst. fuer Aeronomie Introduction to Satellite Data Process. Feb. 1973 p 115-125 refs In GERMAN (For availability see N73-33852 24-31)

The attitude determination of the Azur satellite is based on a coordinate transformation matrix containing time dependant Euler angles. Measurement of these angles allows calculating the satellite attitude. The angles can be obtained from attitude sensor and magnetometer data. ESRO

**N73-33859** Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.
**DATA PRESENTATION TECHNIQUES**
G. R. Pilkington *In its* Introduction to Satellite Data Process. Feb. 1973 p 127-142 refs (For availability see N73-33852 24-31)

Various methods of presenting satellite telemetry data are discussed. The methods are: lists, graphs obtained from line printers, digital plotter and hardcopy plots, optical digital plotters, microfilm camera, and three dimensional plots in two dimensional presentation. The advantages and disadvantages of each technique are pointed out. The quantity of data and the computing time to be expected is indicated, using the Explorer 40 satellite as an example. Analog display techniques are mentioned. ESRO

**N73-33860** Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.
**PLANNING OF SATELLITE DATA PROCESSING [PLANUNG DER DURCHFUEHRUNG DER SATELLITENDATEN-V ERARBEITUNG]**
J. W. Muench *In its* Introduction to Satellite Data Process. Feb. 1973 p 143-161 refs In GERMAN (For availability see N73-33852 24-31)

Possible strategies for computer processing of satellite telemetry data are discussed. The data processing is regarded as a form of production process. The object is to obtain files of scientific data. Processing is planned on the basis of a final date, optimal use of labor, and low costs. To this end, the input data material is evaluated, and the labor process is divided into several parts to make it flexible. The choice of computer is also discussed. ESRO

**N73-33861#** Los Alamos Scientific Lab., N.Mex.
**ATMOSPHERE-ENTRY BEHAVIOR OF A MODULAR, DISK SHAPED, ISOTOPE HEAT SOURCE**
J. W. Vorreiter, J. H. Burns, W. C. Pitts, and H. A. Stine 1973 52 p refs
(Contract W-7405-eng-36)
(LA-UR-73-741; Conf-730811-7) Avail: NTIS HC $4.75 CSCL 22B

The entry and impact behavior of an isotope heat source for space nuclear power that disassembles into a number of modules that would enter the earth's atmosphere sparately in the event of a flight abort are described. These modules are disk-shaped units each with its own reentry heat shield and protective impact contrainer. In normal operation the disk modules are stacked together inside the generator but during a reentry abort they separate and fly as individual units of low ballistic coefficient. Flight tests at hypersonic speeds have confirmed that a stack of disks will separate and assume a flat-forward mode of flight. Free fall tests of single disks have demonstrated a nominal 100 ft/s sea level impact velocity for a practical range of ballistic coefficients. Thermal and structural calculations indicate reentry survival under all possible reentry conditions for speeds up to and including earth escape speed. Author (NSA)

**N73-33862#** Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).
**THE STABILIZATION SYSTEM OF THE SYMPHONIE SATELLITE AND RESULTS OF ITS DYNAMIC SIMULATION [DAS STABILISIERUNGSSYSTEM DES SATELLITEN SYMPHONIE UND ERGEBNISSE SEINER DYNAMISCHEN SIMULATION]**
M. Clautrier, B. Fabis, and M. Fourquet 7 May 1973 14 p In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17 May 1973
(DGLR-Paper-73-045) Avail: NTIS HC $3.00

Results of the dynamic simulation of the Symphonie satellite's attitude control system are presented. The essential requirements and limitations of the stabilization system were derived from the system specification. The subsystems necessary to carry out the tasks of the attitude control system are described. Dynamic simulation of the stabilization system using a specially developed dynamic simulator is reported. ESRO

**N73-33863#** Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
**APPLICATION OF ELECTRIC PROPULSION SYSTEMS TO COMMUNICATION SATELLITE CONTROL [EINSATZ VON ELEKTRISCHEN STEUERTRIEBWERKEN IN NACHRICHTENSATELLITEN]**
Winfried Selke 1973 32 p refs In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17 May 1973 Sponsored by Bundesmin. Fuer Forsch. und Technol.
(DGLR-Paper-73-048) Avail: NTIS HC $3.75

The application mercury ion engines to attitude control of communication satellites was investigated. It was found that the use of these engines for north-south attitude control can lead to a considerable mass benefit of 10 to 15% of the satellite mass as compared to conventional solutions. This difference can be used entirely for the installation of additional payload, such as an increase of transmission capacity by one channel for a direct television broadcasting satellite. Mercury ion engines with thrusts between 5 and 10 mN are seen as most faborable for this use. ESRO

**N73-33864#** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
**ROTARY AND REGULATING MECHANISMS FOR COMMUNICATION SATELLITES [DREH- UND STELLMECHANISMEN FUER NACHRICHTEN-SATELLITEN]**
R. Hostenkamp 1973 12 p refs In GERMAN Presented at the DGLR Symp. NachrichtenSatelliten, Stuttgart, 16-17 May 1973
(DGLR-Paper-73-050) Avail: NTIS HC $3.00

Mechanical drives for communication satellites are described which are used for orientation of antennas towards the earth, orientation of solar generators towards the sun, and deployment of solar generators. The despin mechanisms of the Intelsat 3 and 4 and the UK communications satellites are discussed. Solar orientation mechanisms of the same satellites are dealt with. In addition, details are given for mechanisms to be used in European communication satellite projects. ESRO

**N73-33865#** Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Advanced Projects and Technology Dept.
**TECHNOLOGICAL PROBLEMS OF A LARGE TV SATELLITE FOR DIRECT RECEPTION [TECHNOLOGISCHE PROBLEME EINES GROSSEN FERNSEHSATELLITEN FUER DIREKTEN EMPFANG]**
H. Schweig 1973 24 p In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17 May 1973
(DGLR-Paper-73-051) Avail: NTIS HC $3.25

The energy production and heat budget subsystems of a direct TV broadcasting satellite are discussed. The existing solutions are analyzed and compared with proposed new solutions. It is shown that for favorable exploitation of these possibilities satellites with up to 8 kW generated power can be accommodated as part of the payload of an Atlas Centaur launch vehicle without fully occupying its capacity payload on the 24th orbit. ESRO

**N73-33866#** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Bereich Raumfahrt.
**PROBLEMS OF TEMPERATURE CONTROL OF HIGH CAPACITY COMMUNICATION SATELLITES AND THEIR MEANS OF SOLUTION [PROBLEME UND LOESUNGSWEGE DER TEMPERATURKONTROLLE BEI NACHRICHTENSATELLITEN GROSSER LEISTUNG]**
J. Hoppe and J. Lorschiedter 1973 40 p refs In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten Stuttgart, 16-17 May 1973
(DGLR-Paper-73-052) Avail: NTIS HC $4.00

A survey of systems which can be used for communication satellite temperature control is presented. The systems discussed are louvers, heat pipes, radiators, latent heat storage, surface coatings, and insulation. These systems are demonstrated by means of a direct TV broadcasting satellite. ESRO

**N73-33867#** Lincoln Lab., Mass. Inst. of Tech., Lexington.
**ATTITUDE CONTROL DYNAMICS FOR LES-8/9**
Norval P. Smith and Roger W. Brockett 27 Jul. 1973 26 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-765548; TN-1973-27; ESD-TR-73-232) Avail: NTIS CSCL 22/1

The equations of motion for a rigid body with a gimbaled momentum wheel and gyro are given here together with their derivation. The authors also give the linearized version of these equations together with the equations for the attitude control system. The linearized system is expressed in terms of transfer

functions relating thruster torque, gimbal motor and wheel motor inputs to small angle responses. Author (GRA)

# 32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

**N73-33868** Rubber and Plastics Research Association of Great Britain, Shrewsbury (England).
**TENSILE STRESS RELAXATION: THE PREDICTION OF AGING CHARACTERISTICS OF RUBBERS**
R. P. Brown, S. H. Morrell, and R. H. Norman Aug. 1972 27 p refs
(RR-204) Copyright. Avail: Issuing Activity

The concept of using tension stress relaxation measurements to investigate rubber networks which are undergoing chemical changes is discussed. The measurement consists basically of monitoring the stress in a sample while subjecting it to an aging procedure, usually accelerated. There are two variants of the technique; continuous relaxation in which the sample is held stretched throughout the test and intermittent in which the sample is stretched only periodically for short times to enable measurements to be made. Under suitable conditions when viscous flow is not dominant it has been proposed that the reactions within the rubber network may be related to stress changes. The decay of stress in continuous relaxation measurements provides a measure of the degradative reactions in the network while intermittent relaxation measures the net effect of both degradative and crosslinking reactions. Author

**N73-33869** Toledo Univ., Ohio.
**PLANE ELASTO-PLASTIC ANALYSIS OF V-NOTCHED PLATE UNDER BENDING BY BOUNDARY INTEGRAL EQUATION METHOD Ph.D. Thesis**
Walter Rzasnicki 1973 328 p
Avail: Univ. Microfilms Order No. 73-19539

A method of solution is presented, which, when applied to the elastic-plastic analysis of plates having a V-notch on one edge and subjected to pure bending, will produce stress and strain fields in much greater detail than presently available. Application of the boundary integral equation method results in two coupled Fredholm-type integral equations, subject to prescribed boundary conditions. These equations are replaced by a system of simultaneous algebraic equations and solved by a successive approximation method employing Prandtl-Reuss incremental plasticity relations. The method is first applied to number of elasto-static problems and the results compared with available solutions. Good agreement is obtained in all cases. The elasto-plastic analysis provides detailed stress and strain distributions for several cases of plates with various notch angles and notch depths. Dissert. Abstr.

**N73-33870** Illinois Univ., Urbana.
**ANALYSIS OF THICK SHELL STRUCTURES Ph.D. Thesis**
William Hofmann Drysdale 1972 109 p
Avail: Univ. Microfilms Order No. 73-17189

A set of equations is developed for the analysis of thick shell structures. Geometric thickness and transverse strain effects are both included. The relations are similar to the Reissner-Naghdi thick shell theory, but the use of order of magnitude arguments on the transverse normal strain leads to simplifications in the strain-displacement equations. Additional equations necessary for a thick shell formulation are obtained by satisfying the boundary conditions of three-dimensional elasticity on the faces of the shell. The present theory is then adapted to finite element procedures for the stress and stability analysis of shells of revolution. The results of the stress analysis is compared to values computed using elasticity theory. Dissert. Abstr.

**N73-33871** New York Univ., N.Y.
**DYNAMIC BUCKLING OF A COMPRESSED NON-LINEAR TIMOSHENKO BEAM Ph.D. Thesis**
Marilyn Sue Hirschhorn 1973 104 p
Avail: Univ. Microfilms Order No. 73-19393

The behavior of a thin elastic beam subjected to a constant, compressive axial displacement 2C is analyzed. A nonlinear version of the Timoshenko beam theory is derived and used in this investigation. The stability of the unbuckled and buckled static states is tested using the linear dynamic theory. The nonlinear dynamic theory is employed to describe the motion of the beam when C is increased slightly above the lowest critical buckling point, and a disturbance is applied to the beam. The two-time method is used to obtain an asymptotic expansion of the solution. Small amplitude periodic solutions are also investigated using a perturbation method. Dissert. Abstr.

**N73-33872** Arizona Univ., Tucson.
**THE FINITE ELEMENT ANALYSIS OF THIN ELASTIC SHELLS Ph.D. Thesis**
James F. Wilson 1973 121 p
Avail: Univ. Microfilms Order No. 73-18211

The desirability of successful applications of finite element theory to shell problems is discussed. Various curved elements for use in thin, elastic shell analysis are investigated. A shell theory referred to arbitrary surface coordinates is illustrated and isoparametric elements for use in axi-symmetric and general surface problems are developed. The elements are used in numerical examples and the results are discussed.
Dissert. Abstr.

**N73-33873** Texas Univ., Austin.
**FINITE ELEMENT FORMULATION OF MIXED AND STRESS VARIATIONAL PRINCIPLES FOR STRUCTURAL DYNAMIC ANALYSIS Ph.D. Thesis**
Calvin Doyle Newsom 1972 162 p
Avail: Univ. Microfilms Order No. 73-18476

Variational principles are utilized to develop finite element relations that are useful in structural dynamic analysis of linearly elastic beam and plate flexure problems. The mixed variational principle due to Reissner contains both stress and deflection parameters in the formulation, and is applicable to static as well as to dynamic problems. The other variational principle is due to Gurtin, and is limited in application to linear elastodynamic problems. Finite element equations, for beams in bending and plates in bending, are developed in detail utilizing both variational principles. Dissert. Abstr.

**N73-33874** Ohio State Univ., Columbus.
**BUCKLING OF ELASTIC FIBERS IN A COMPOSITE PLATE WITH VISCOELASTIC MATRIX Ph.D. Thesis**
Ting-tsai Tseng 1973 72 p
Avail: Univ. Microfilms Order No. 73-18959

An analysis of the internal buckling of the fibers in a viscoelastic composite plate is presented. The possibility of the existence of time dependent buckling phenomena due to stress relaxation in the matrix is discussed. As a first approximation, the fiber is treated as an elastic column supported by a continuous distribution of discrete viscoelastic springs. An initial deviation from straightness of the fibers is included in the analysis. Linear material responses and small deflection theory is assumed throughout. The viscoelastic material properties are expressed in an exponential series form which makes it convenient to incorporate actual material behavior in the analysis. Eigenfunction expansions are used to reduce the governing equation to a set of linear ordinary differential equations. The instability conditions are then determined from the characteristics of the coefficients in these expansions. Dissert. Abstr.

**N73-33875** Northeastern Univ., Boston, Mass.
**A STUDY INTO THE BEHAVIOR OF UNSYMMETRICALLY LAYERED ANISOTROPIC PLATES Ph.D. Thesis**
Richard Camille Fortier 1972 207 p
Avail: Univ. Microfilms Order No. 73-18386

An investigation into the behavior of unsymmetrically laminated anisotropic plates is carried out. Using the basic assumptions of linear plate theory and strain-displacement relations modified to account for small initial curvature, energy formulations are established, and the Ritz method is utilized to arrive at solutions to the static deflection and natural frequency eigenvalue problems. A closed-form solution for the nature

frequencies of vibration for one plate configuration is obtained in which transverse shear deformation as well as initial curvature are included. Three hinge-type boundaries and a fully restrained boundary are modeled to ascertain the effect of different edge restraints on plate response. The boundary condition imposed, and in particular the type of restraint on the inplane displacements, is shown to have an important effect on behavior when bending-extensional coupling is present. Dissert. Abstr.

**N73-33876** Illinois Univ., Urbana.
**SECTION AND NOTCH SIZE EFFECTS IN FATIGUE Ph.D. Thesis**
David Thomas Raske 1972 126 p
Avail: Univ. Microfilms Order No. 73-17378

The influence of size effects on the fatigue strength of metals has been studied. These effects were separated into two categories: Size or scale effects associated with changes in section size or length when stress or strain gradients are absent, and size effects associated with geometrical stress concentrations that produce stress and strain gradients. The findings indicate that the effect of specimen size on fatigue strength when stress gradients are absent is volume controlled, and can be determined by a simple mathematical relation between fatigue strength and volume. In the presence of geometrical stress concentrations, size effects are controlled by a critical volume at the notch root and the severity of the stress or strain gradient. A means to determine the fatigue notch factor KSUBF was devised by identifying the zone of metal at the notch root which is thought to govern the fatigue process. Dissert. Abstr.

**N73-33877** Illinois Univ., Urbana.
**ELASTIC STRESS ANALYSIS OF AN ADHESIVE LAP JOINT SUBJECTED TO TENSION, SHEAR FORCE AND BENDING MOMENTS Ph.D. Thesis**
Murlidhar Hakumatrai Pahoja 1972 168 p
Avail: Univ. Microfilms Order No. 73-17349

A stress analysis of the lap joint is presented treating the problem as one of plane strain. The joint is subjected to a general loading, consisting of tension, shear force and bending moments. The variation in the material properties and thickness of the two adherends is considered. The displacement field in the adhesive layer is expressed in series form and the compatibility condition at the interface is used to express the displacement field in the adherends. The potential energy of the joint is calculated and minimized to obtain linear, ordinary differential equations and boundary conditions. The differential equations are solved on the computer. Photoelasticity is used to confirm the theory. Dissert. Abstr.

**N73-33878*#** Northrop Corp., Hawthorne, Calif. Aircraft Div.
**INVESTIGATION OF VIBRATIONAL ENERGY TRANSFER IN CONNECTED STRUCTURES Final Report, Mar. 1972 - Jun. 1973**
Chintsun Hwang and W. S. Pi Jul. 1973 132 p refs
(Contract NAS8-28171)
(NASA-CR-124450; NOR-73-105) Avail: NTIS HC $8.75 CSCL 20K

The results are reported of an analytical and experimental investigation on the vibrational energy transfer between connected substructures under random excitation. In the analytical area, the basic foundation and assumptions of the statistical energy analysis (SEA) method, a major tool in random response analysis of structures, were examined and reviewed. A new SEA formulation based on the strong coupling condition of the substructures was carried out and presented. Also presented were the results of vibration energy transfer study based on the wave equations applied to connected structures. In the experimental phase, three simple structural models were fabricated and tested. Additional tests were performed on selected substructures which formed parts of the test models. The test results were presented and evaluated against the analytical data. Author

**N73-33879*#** Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
**STRAIN ENERGY DENSITY AND SURFACE LAYER ENERGY FOR A CRACK-LIKE ELLIPSE**
M. E. Kipp and G. C. Sih Jun. 1973 44 p refs
(Grant NGR-39-007-066)
(NASA-CR-132338; NASA-TR-73-3; IFSM-73-43) Avail: NTIS HC $4.25 CSCL 20K

Some of the fundamental concepts of sharp crack fracture criteria are applied to cracks and narrow ellipses. The strain energy density theory is extended to notch boundaries, where the energy in a surface layer is calculated and the location of failure initiation is determined. The concept of a core region near the notch tip, and its consequences, are examined in detail. The example treated is that of an elliptical cavity loaded uniformly at a large distance from the hole, and at an angle to the hole; the results are shown to approach that of the crack solution for narrow ellipses, and to display quite satisfactory agreement with recently published experimental data under both tensile and compressive loading conditions. Results also indicate that in globally unstable configurations in brittle materials, the original loading and notch geometry are sufficient to predict the subsequent crack trajectory with considerable accuracy. Author

**N73-33880#** Cranfield Inst. of Technology (England).
**A STUDY OF HE CHARPY V-NOTCH IMPACT TEST**
E. Smith May 1973 20 p refs
(Cranfield-Mat-10) Avail: NTIS HC $3.00

Dimensional changes and the development of cracking in the Charpy V-notch impact test have been studied using a low energy blow technique. Notch opening, angle of bend, notch root concentration and lateral expansion are shown to be proportional to the energy of the low blow which does not cause complete fracture and to be relatively independent of temperature over the range minus 10 C to minus 70 C but dependent on material. When complete fracture occurs the same lateral expansion/energy relationship still holds for brittle fractures but gradually breaks down as the plasticity of the specimen increases. This is due to an appreciable energy increment involved in forming the shear lips on the sides of the specimen without corresponding increase in lateral expansion. The lateral expansion after complete fracture is shown to be independent of the number and magnitude of blows taken to fracture. Author

**N73-33881#** Technische Hogeschool, Delft (Netherlands). Afdeling der Werktuigbouwkunde.
**NONLINEAR ANALYSIS OF STRUCTURES BY THE FINITE ELEMENT METHOD AS A SUPPLEMENT TO LINEAR ANALYSIS**
J. F. Besseling Sep. 1973 26 p refs
(WTHD-51) Avail: NTIS HC $3.50

The nonlinear analysis of structures by the finite element method as a supplement to a linear analysis is discussed. The element deformations, linearly related to nodal displacements and rotations in a local coordinate system, are expressed as analytic functions of the nodal coordinates in the global system. For structures with an initially linear behavior, the stability and postbuckling analysis is developed. The theory is illustrated by the example of frame structures. Author

**N73-33882#** Kyushu Univ., Fukuoka (Japan). Faculty of Engineering.
**STRESS STATES OF A FINITE PLATE CONTAINING A HOLE**
Keinosuke Gotoh Aug. 1973 22 p refs *Its* Mem. of the Fac. of Eng., Vol. 33, No. 1
Avail: NTIS HC $3.25

A general method for determining the stresses and displacements in a finite plate having a hole of various shape is presented. The method of solution is a combination of the complex variable method, a conformal mapping technique and the point matching approach. Numerical calculations are carried out for square plates in uniform tension or compression which contain circular, elliptical, and regular polygonal holes. Results are given in graphical form showing the variations of stress concentration factors with the size of the hole, aspect ratio, and corner radius. Some of the results are compared with published theoretical or experimental values, and the validity of the method is clarified. Author

**N73-33883*#** Martin Marietta Corp., Denver, Colo.
**HYPERSONIC WING TEST STRUCTURE DESIGN, ANALYSIS, AND FABRICATION Final Report**

P. P. Plank and F. A. Penning Aug. 1973 154 p refs
(Contract NAS4-1845)
(NASA-CR-127490) Avail: NTIS HC $9.75 CSCL 01C

An investigation to provide the analyses, data, and hardware required to experimentally validate the beaded panel concept and demonstrate its usefulness as a basis for design of a Hypersonic Research Airplane (HRA) wing is reported. Combinations of the beaded panel structure, heat shields, channel caps and corrugated webs for ribs and spars were analyzed for the wing of a specified HRA to operate at Mach 8 with a lifespan of 150 flights. Detailed analyses were conducted in accordance with established design criteria and included aerodynamic heating and load predictions, transient structural thermal calculations, extensive NASTRAN computer modeling, and structural optimization. Optimum beaded panel tests at 922 K (1200 F) were performed to verify panel performance. Close agreement of predicted and actual critical loads permitted use of design procedures and equations for the beaded panel concept without modification. Author

**N73-33884#** Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
**ASYMMETRICAL BENDING AND VIBRATION OF A CONICAL SHELL FINITE ELEMENT**
T. Y. Yang and H. W. Kim May 1973 36 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Mar. 1974
(TR-73-5-2) Avail: NTIS HC $4.00

The stiffness and mass matrices for a high order trapezoidal, circular, conical shell finite element are formulated. The same bicubic shape functions are assumed for all of the three orthogonal displacement components. The circumferential radius of curvature and Lame parameter vary linearly with the meridional axis within the element. The element formulations are accomplished by an organized exact integration procedure and are presented explicitly. Evaluations of the formulations are performed for the cases of asymmetrical bending and free vibration of segments of conical shells. The results for static displacements and natural frequencies converge monotonically and rapidly with mesh refinement. The converged results are in good agreement with alternative known approximate solutions. Author

**N73-33885*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**AN APPROXIMATE SOLUTION FOR THE FREE VIBRATIONS OF ROTATING UNIFORM CANTILEVER BEAMS**
David A. Peters Sep. 1973 42 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62299) Avail: NTIS HC $4.25 CSCL 20K

Approximate solutions were obtained for the uncoupled frequencies and modes of rotating uniform cantilever beams. The frequency approximations for flap bending, lead-lag bending, and torsion are simple expressions having errors of less than a few percent over the entire frequency range. These expressions provide a simple way of determining the relations between mass and stiffness parameters and the resultant frequencies and mode shapes of rotating uniform beams. Author

**N73-33886*#** Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
**A REVIEW OF DEVELOPMENTS IN THE THEORY OF ELASTO-PLASTIC FLOW**
J. L. Swedlow Washington NASA Nov. 1973 74 p refs
(Grant NGL-39-002-023)
(NASA-CR-2321; SM-73-8) Avail: NTIS HC $3.50 CSCL 20K

The theory of elasto-plastic flow is developed so that it may accommodate features such as work-hardening, anisotropy, plastic compressibility, non-continuous loading including local or global unloading, and others. A complete theory is given in quasi-linear form; as a result, many useful attributes are accessible. Several integral theorems may be written, finite deformations may be incorporated, and efficient methods for solving problems may be developed; these and other aspects are described in some detail. The theory is reduced to special forms for 2-space, and extensive experience in solving such problems is cited. Author

**N73-33887*#** Grumman Aerospace Corp., Bethpage, N.Y.
**FLUTTER ANALYSIS AND TESTING OF PAIRS OF AERODYNAMICALLY INTERFERING DELTA WINGS Final Report**
Richard R. Chipman and Frank J. Rauch Washington NASA Nov. 1973 95 p refs
(Contract NAS1-10635-7)
(NASA-CR-2331) Avail: NTIS HC $3.75 CSCL 01B

To examine the effect on flutter of the aerodynamic interference between pairs of closely spaced delta wings, several structurally uncoupled 1/80th-scale models were studied by experiment and analysis. Flutter test boundaries run in a 26-in transonic blowdown wind tunnel were compared with subsonic analytical results generated using the doublet lattice method. Trends for several combinations of vertical and longitudinal wing separation showed that flutter speeds can be significantly lowered in closely spaced configurations. For some configurations, a new flutter mechanism, characterized by coupling of the flexible modes from both surfaces at a distinctive flutter frequency, was predicted and observed. Author

**N73-33888#** Central Electricity Generating Board, Berkeley (England). Research Dept.
**HIGH-TEMPERATURE LOW-CYCLE FATIGUE EFFECT OF NOTCHES**
T. R. Cook Feb. 1973 26 p refs
(RD/B/N-1996) Avail: AEC Depository Libraries HC $3.50

Results of tests on notched, directly stressed, fatigue specimens are reported and are compared with plain specimen tests made under similar conditions. The test material was 20% Cr-25% Ni stainless steel, and the data were obtained at 700 C. The results indicated that the Neuber formula yielded very pessimistic predictions when using strain as the crack initiation criterion. The predicted endurances were modified using the results of an evaluation of the effect of strain rate. These predictions were more realistic, but were generally still pessimistic. It is therefore concluded that the notch effect is not as damaging as the predictions indicated for this case. Author (NSA)

**N73-33889#** Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.
**THREE-DIMENSIONAL ARTICULATED NODE STRUCTURES [CONTRIBUTION A L'ETUDE DES STRUCTURES SPATIALES A NOEUDS ARTICULES]**
Jorge O. Garcia (Liege Univ.) Jun. 1973 83 p In FRENCH Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-MT-82) Copyright. Avail: NTIS HC $6.25

Three computer programs for three-dimensional civil engineering lattice structures are presented. The lattice is made of prismatic rods connected by kinematically stable frictionless nodes. For each rod, modules of elasticity and cross section are required. The first program (STAIR) calculates node displacements and normal tensions in the rods by the partitioned matrix method. The method is described together with parallel and series node elimination procedures. The program may handle single layer lattices, single and double layer lattice cupolas, and pylons of any shape. The second program (PRESTA) automatically generates the data required by STAIR from a minimum of fundamental data (arbitrary numbering of nodes). Program options are: drawing only, computation only, or drawing and computation for any given structure. The third program (GASP) is devoted to repetitive lattices and is compatible with STAIR and PRESTA. For each program flow charts, input/output procedures, and examples are given. ESRO

**N73-33890#** Stanford Univ., Calif. Dept. of Applied Mechanics.
**VISCOELASTIC EFFECTS IN THE DESIGN OF EQUIPMENT AND STRUCTURES Interim Report**
E. H. Lee Jun. 1973 15 p refs
(Contract N00014-67-A-0112-0060; NR Proj. 064-471)
(AD-764555; SUDAM-73-3; Rept-20) Avail: NTIS CSCL 20/11

In recent years the greatly increased use of polymers in the manufacture of components and equipment has led to an increased need for the application of viscoelastic stress analysis to ensure satisfactory design and operation of such items. Moreover,

other materials, the structural application of which has been commonly based on elastic analysis, have been found to exhibit rate and time dependent properties on the basis of more precise measurements. The creep and viscoelastic response of concrete provides an example. Viscoelastic material characteristics can have either a beneficial or detrimental effect on the performance of an item of equipment. For example the associated damping may be needed to reduce vibration, or creep deformation might reduce load carrying capacity. Examples of such problems which have arisen in practice are described. Author (GRA)

**N73-33891*#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**NONLINEAR PROBLEMS OF THE THEORY OF HETEROGENEOUS SLIGHTLY CURVED SHELLS**
B. Ya. Kantor 25 Jul. 1973 153 p refs Transl. into ENGLISH of the publ. "Nelineinye Zadachi Teorii Neodnorodnykh Pologikh Obolochek" USSR, 1971 p 1-136
(AD-765543; FTD-MT-24-220-73) Avail: NTIS CSCL 20/1

An account if given of the variational method of the solution of physically and geometrically nonlinear problems of the theory of heterogeneous slightly curved shell's. Examined are the bending and supercritical behavior of plates and conical and spherical cupolas of variable thickness in a temperature field, taking into account the dependence of the elastic parameters on temperature. The bending, stability in general and load-bearing capacity of flexible isotropic elastic-plastic shells with different criteria of plasticity, taking into account compressibility and hardening. The effect of the plastic heterogeneity caused by heat treatment, surface work hardening and irradiation by fast neutron flux is investigated. Some problems of the dynamic behavior of flexible shells are solved. Calculations are performed in high approximations. Considerable attention is given to the construction of a machine algorithm and to the checking of the convergence of iterative processes. GRA

# 33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

**N73-33892** Auburn Univ., Ala.
**THERMAL CONDUCTIVITY OF RANDOMLY PACKED GRANULAR MATERIALS Ph.D. Thesis**
Roger Alan Crane 1973 149 p
Avail: Univ. Microfilms Order No. 73-16258

An analytical technique for predicting the effective thermal conductivity of granular materials was developed. The method includes an extension of the fundamental approaches originally proposed by Wiener and Tsao. However, the present model is extended to include a more realistic geometrical arrangement of the solid particles and to incorporate modifications to the heat flow assumptions. Results of packing theory are incorporated into a basic geometrical model. This allows a selected system to be represented by a distribution which is physically realistic. Three correlations are presented for determining the effective thermal conductivity of granular systems. These correlations are compared with a number of correlations previously contained in the literature. A fairly extensive comparison with experimental results indicates that the proposed correlations represent a significant improvement over most of the previous formulations. Dissert. Abstr.

**N73-33893** State Univ. of New York, Buffalo.
**ENGINEERING, HEAT LOCAL THERMAL EQUILIBRIUM IN A TRANSIENT CO-AXIAL ARGON ARC Ph.D. Thesis**
August Albert Cenkner, Jr. 1973 168 p
Avail: Univ. Microfilms Order No. 73-19181

An experimental study has been performed to determine the instantaneous thermodynamic state in a cascade argon arc after initiation of a step increase in electrode voltage from an initial steady-state d.c. level. The laminar gas flow in the 1 cm diameter 14 cm long coaxial arc was maintained at 0.1 gm/sec while experiments were performed at pressure levels of 9.8, 15.85, and 21.7 psia. At these pressures, the initial currents were 195, 180, and 170 amperes, respectively. The voltage step risetime was about 50 while the corresponding 40 ampere current increase risetime was about 400 microseconds at all pressure levels. Line and adjacent continuum radiation were simultaneously monitored during numerous time intervals after initiation of the transient. Experimental emission coefficients were compared, via equilibrium characteristics curves with theoretical equilibrium coefficients. Dissert. Abstr.

**N73-33894** California Inst. of Tech., Pasadena.
**INVESTIGATION OF SUPERCRITICAL HEAT FLOW IN HELIUM 2 Ph.D. Thesis**
Pavlos Emmanuel Dimotakis 1973 105 p
Avail: Univ. Microfilms Order No. 73-18370

To investigate the validity of appending the Gorter-Mellink friction term to the equations of motion of liquid helium the temperature was measured along the axis of a channel carrying a supercritical heat current. A single thermometer on a traversing assembly was used permitting local measurements both in the interior of the channel and in the jet formed in the free fluid. The temperature gradient in the interior of the channel is found to be in agreement with the Gorter-Mellink law up to the lambda point, but goes to zero within a channel diameter, in the free jet. Since the relative velocity between the two fluids is probably continuous along the axis of the jet in the vicinity of the exit, the disappearance of the temperature gradient appears to be inconsistent with the predictions of the Gorter-Mellink term. Dissert. Abstr.

**N73-33895** New York Univ., N.Y.
**EXPERIMENTAL STUDY OF THE LAMINAR-FLOW HEAT TRANSFER COEFFICIENT OF A FLUID WITH A PRESCRIBED WALL HEAT FLUX Ph.D. Thesis**
Otto I. Reisman 1973 94 p
Avail: Univ. Microfilms Order No. 73-19401

In 1966, Kays derived a heat transfer solution for a sinusoidal wall heat flux. The objective of this thesis was to obtain experimental data to compare with Kays' theoretical solution. An analytic solution for a step-varying wall heat flux was derived and verified experimentally. The heat transfer experiment was performed, and the wall and fluid temperatures, as well as other pertinent data were recorded. The oil flow was maintained constant until all temperatures reached steady state condition. The experiment was repeated to assure invariance with time of the data. The measured wall temperatures were then compared with the theoretical solution at three points along the tube. Good agreement was found at two of the points where the experimental data differed by less than 6% from the the theoretical curve. Dissert. Abstr.

**N73-33896** State Univ. of New York, Buffalo.
**THERMODYNAMICS OF AN ELECTRON GAS IN A MAGNETIC FIELD Ph.D. Thesis**
Jui-Tien Tsai 1973 104 p
Avail: Univ. Microfilms Order No. 73-19243

Studies of the thermodynamic properties of an electron gas in a magnetic field were conducted. The studies were conducted using the grand partition function formalism. The thermodynamic properties were determined for weak, intermediate, and strong magnetic fields. The characteristics of each type of magnetic field are analyzed. An evaluation was made of the magnetic susceptibility of alkali metals. Dissert. Abstr.

**N73-33897** Wisconsin Univ., Madison.
**AN EXPERIMENTAL AND A THEORETICAL INVESTIGATION OF EXPANDING REACTION ZONES IN EXPLOSIVE MIXTURES OF ACETYLENE AND OXYGEN Ph.D. Thesis**
William Thomas Vyn 1973 143 p
Avail: Univ. Microfilms Order No. 73-15998

The results of two studies of the explosive characteristics of detonable gas mixtures are presented. The first study consists of an experimental investigation of cylindrically expanding flames initiated by an exploding wire source. The wave structure was studied by streak and framing schlieren photography, piezoelectric pressure transducers, and a velocity measurement section. By

varying the energy released, regions were observed where asymmetric accelerating shock-flame complexes were created which would transform into steady detonation waves. These results conflicted with earlier published data where either a decoupled deflagration and wave or an overdriven detonation were formed. The discrepancy was traced to the ignition source which was discharging in a complex oscillatory manner rather than the more usual single pulse. Dissert. Abstr.

**N73-33898*#** McDonnell-Douglas Astronautics Co., Richland, Wash.
**HEAT PIPE THERMAL CONDITIONING PANEL Detailed Technical Report, 28 Jun. 1972 - 12 Aug. 1973**
E. W. Saaski Sep. 1973 50 p refs
(Contract NAS8-28639)
(NASA-CR-124451; MDC-G4421) Avail: NTIS HC $4.50 CSCL 20M

The technology involved in designing and fabricating a heat pipe thermal conditioning panel to satisfy a broad range of thermal control system requirements on NASA spacecraft is discussed. The design specifications were developed for a 30 by 30 inch heat pipe panel. The fundamental constraint was a maximum of 15 gradient from source to sink at 300 watts input and a flux density of 2 watts per square inch. The results of the performance tests conducted on the panel are analyzed. Author

**N73-33899*#** McDonnell-Douglas Astronautics Co., Richland, Wash.
**HEAT PIPE THERMAL CONDITIONING PANEL Executive Summary Report, 28 Jun. 1972 - 12 Aug. 1972**
E. W. Saaski Sep. 1973 26 p refs
(Contract NAS8-28639)
(NASA-CR-124453; MDC-G4422) Avail: NTIS HC $3.50 CSCL 20M

The development, fabrication, and evaluation of heat pipe thermal conditioning panels are discussed. The panels were designed and fabricated to be compatible with several planned NASA space vehicles, in terms of panel size, capacity, temperature gradients, and integration with various heat exchangers and electronic components. It was satisfactorily demonstrated that the heat pipe thermal conditioning panel meets the thermal efficiency and heat transport requirements. Author

**N73-33900*#** New Mexico Univ., Albuquerque. Technology Applications Center.
**HEAT PIPE TECHNOLOGY: A BIBLIOGRAPHY WITH ABSTRACTS Cumulative Volume**
31 Mar. 1971 239 p refs Sponsored by NASA
(NASA-CR-135953; TAC-Bibl-1) Avail: NTIS HC $14.00 CSCL 20M

A cumulative bibliography on heat pipe research and development projects is presented. The subjects discussed are: (1) general information, (2) heat pipe applications, (3) heat pipe theory, (4) design and fabrication, (5) testing and operation, (6) subject and author index, and (7) heat pipe related patents. Author

**N73-33901*#** New Mexico Univ., Albuquerque. Technology Applications Center.
**HEAT PIPE TECHNOLOGY Quarterly Update, 1 Jan. - 31 Mar. 1972**
31 Mar. 1972 26 p refs Sponsored by NASA
(NASA-CR-135956; TAC-BIBL-1(72/1)) Avail: NTIS HC $3.50 CSCL 20M

A bibliography of heat pipe technology to provide a summary of research projects conducted on heat pipes is presented. The subjects discussed are: (1) heat pipe applications, (2) heat pipe theory, (3) design and fabrication, (4) testing and operation, (5) subject and author index, and (6) heat pipe related patents. Author

**N73-33902*#** New Mexico Univ., Albuquerque. Technology Application Center.
**HEAT PIPE TECHNOLOGY: A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Update, 1 Apr. - 30 Jun. 1972**
30 Jun. 1972 35 p refs Sponsored by NASA
(NASA-CR-135955; TAC-BIBL-1(72/2)) Avail: NTIS HC $3.75 CSCL 20M

A bibliography of heat pipe research and development projects conducted during April through June 1972, is presented. The subjects discussed are: (1) general information, (2) heat pipe applications, (3) heat pipe theory, (4) design and fabrication, (5) test and operation, (6) subject and author index, and (7) heat pipe related patents. Author

**N73-33903*#** New Mexico Univ., Albuquerque. Technology Application Center.
**HEAT PIPE TECHNOLOGY: A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Update, 1 Jul. - 30 Sep. 1972**
30 Sep. 1972 42 p refs Sponsored by NASA
(NASA-CR-135952; TAC-BIBL-1(72/3)) Avail: NTIS CSCL 20M

A bibliography of heat pipe research and development projects conducted during July through September, 1972 is presented. The subjects discussed are: (1) general information, (2) heat pipe applications, (3) heat pipe theory, (4) design and fabrication, (5) testing and operation, (6) subject and author index, and (7) heat pipe related patents. Author

**N73-33904*#** New Mexico Univ., Albuquerque. Heat Pipe Information Office.
**HEAT PIPE TECHNOLOGY: A BIBLIOGRAPHY WITH ABSTRACTS Annual Supplement, 1971**
1971 102 p refs
(NASA-CR-135951; TAC-Bibl-1(71/2)) Avail: NTIS HC $7.25 CSCL 20M

The annual supplement on heat pipe technology for 1971 is presented. The document contains 101 references with abstracts and 47 patents. The subjects discussed are: (1) heat pipe applications, (2) heat pipe theory, (3) design, development, and fabrication of heat pipes, (4) testing and operation, (5) subject and author index, and (6) heat pipe related patents. Author

**N73-33905*#** Weiner Associates, Inc., Cockeysville, Md.
**FEASIBILITY STUDY OF A HIGH TEMPERATURE RADIATION FURNACE FOR SPACE APPLICATIONS Final Report**
A. Eiss, B. Dussan, W. Shadis, and L. Frank Apr. 1973 82 p refs
(Contract NAS8-28059)
(NASA-CR-124458; WAI-101) Avail: NTIS HC $6.25 CSCL 20M

The feasibility was investigated of a high temperature general purpose furnace for use in space. It was determined that no commercial furnaces exist which could, even with extensive modifications, meet the goals of temperature, power, weight, volume, and versatility originally specified in the contract Statement of Work. A feasible furnace design which does substantially meet these goals while employing many of the advanced features of the commercial furnaces is developed and presented. Author

**N73-33906#** Louvain Univ. (Belgium).
**STABILITY OF THE VAPOR FILM DURING FILM BOILING FROM HORIZONTAL CYLINDERS**
J. Berghmans [1973] 27 p refs
Avail: NTIS HC $3.50

The stability of the vapor film formed on horizontal cylinders during stable film boiling is studied by means of a variational approach. The wavelength of the most dangerous perturbation of the interface is found to depend only upon the radius of the heater and a dimensional parameter representing the relative effect of gravity and surface tension. This theoretically calculated wavelength is in very good agreement with the experimental observations. Author

**N73-33907#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**NUMERICAL INVESTIGATION OF THE PROBLEM OF THE EXPLOSION OF A FINITE CYLINDRICAL CHARGE**
L. V. Shurshalov [1973] 11 p refs Transl. into ENGLISH from Vychisl. Matem. i Matem. Fiz. (Moscow), v. 13, no. 4 p 971-983
Avail: NTIS HC $3.00, National Translations Center, John Crerar Library, Chicago, Illinois 60616

A numerical investigation of the explosion of a finite

cylindrical charge was conducted. A finite difference method was used for the numerical solution of the problem. The conditions under which the tests were conducted are described. The nature of the propagation of the shock waves following the explosion is diagrammed. P.N.F.

**N73-33908#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**IGNITION OF BERYLLIUM**
P. F. Pokhil, A. F. Beliaev, Iu V. Frolov, V. S. Logachev, and A. I. Korotkov [1973] 9 p refs Transl. into ENGLISH of the book "Gorenie Poroshkoobraznykh Metallov v Aktivnykh Sredakh" Moscow, Nauka, 1972 p 104-113
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The ignition properties and combustion physics of beryllium are discussed. The products of combustion are described. Safe methods for conducting the ignition tests are reported. Graphs are included to show the effects of various parameters on the ignition of beryllium. P.N.F.

**N73-33909*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**PHENOMENA ASSOCIATED WITH BENCH AND THERMAL-VACUUM TESTING OF SUPERCONDUCTORS, HEAT PIPES**
James P. Marshburn Washington Nov. 1973 12 p refs
(NASA-TN-D-7395; G-7342) Avail: NTIS HC 2.75 CSCL 20M

Phenomena associated with heat pipe system failures or individual heat pipe failures can in general be classified as follows: (1) evaporator overheating, (2) condenser dropout, (3) noncondensable gas generation or collection, (4) surge and partial recovery of evaporator temperatures, (5) masking of thermal profiles by attached masses, and simple malfunctions due to leaks and mechanical failures or flaws. Examples of each of these phenomena are discussed along with some corrective repairs and recommendations. Author

**N73-33910#** Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
**COOLING OF LONG TUBES WITH SUPERFLUID HELIUM**
G. Krafft Apr. 1973 86 p refs In GERMAN
(KFK-1786) Avail: AEC Depository Libraries HC $6.50

Heat transport experiments with superfluid helium in pipes of 60 to 400 cm length and diameters between 0.3 to 1.0 cm show the existence of a critical heat flow density, when superfluidity breaks down and vaporization onset starts. The critical heat flux is mainly determined by the amount of superheating required for bubble formation. Assuming that nucleation occurs on the superfluid vortex lines or vortex rings the measured values of superheat can be explained. Author (NSA)

**N73-33911#** Los Alamos Scientific Lab., N.Mex.
**EXPLOSIVE CARBON BURNING**
W. Michael Howard 1973 10 p refs Presented at Conf. on Explosive Nucleosynthesis, Austin, Tex., 2-3 Apr. 1973
(Contract W-7405-eng-36)
(LA-UR-73-489; Conf-730415-1) Avail: NTIS HC $3.00

The effects or explosive carbon burning are far reaching in producing many of the observed nuclei in the solar system; however, the results depend upon many nuclear and hydrodynamical details. A consistent theory of explosive carborn burning that produces the Mg isotopes as well as the rare neutron-rich nuclei in their proper solar system abundance ratios will place severe constraints on allowable supernova explosions. Tables of important nuclear reactions and overproduction factors for various isotopes are given. NSA

**N73-33912#** Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
**MEASUREMENT OF HEAT CONDUCTIVITY OF SOLUTION OF He-3-He-4 AT SUPERFLOW TEMPERATURE**
N. S. Borisov, B. S. Neganov, and G. Feller 1973 10 p refs In RUSSIAN
(JINR-P8-7008) Avail: AEC Depository Libraries HC $3.00

Heat conductivity Kappa was measured for 6.4% solution of He-3 and He-4 in the temperature range from 0.008 K to 0.1 K. For the region lower than 0.01 K the dependence is obtained through Kappa T = 30.5 erg/sq cm. Measurement capillary diameter is 3.5 mm. Author (NSA)

**N73-33913#** California Univ., Livermore. Lawrence Livermore Lab.
**INFLUENCE OF SCREENING EFFECTS ON CARBON IGNITION**
H. C. Graboske, Jr. 29 Mar. 1973 14 p refs Presented at the Explosive Nucleosynthesis Conf., Austin, Tex., 2 Apr. 1973 Revised Sponsored by AEC
(UCRL-74669-Rev-1; CONF-730415-2) Avail: NTIS HC $3.00

A generalized screening theory has produced a revised strong screening factor which significantly reduces the densities at which carbon ignition can occur in helium-exhausted carbon-oxygen stellar core models. The form of the strong screening factor causes a reversal in the temperature dependence of the carbon energy generation rate at tou/gamma sub 6 = 7, which leads to a double-valued set of carbon ignition lines. Current nuclear energy rates and neutrino emission processes indicate carbon ignition must occur centrally and at densities of the order of 2 to 3 x 10 to the 9th power gm cu cm. A possible mechanism is suggested for nonviolent carbon ignition in a highly degenerate fuel. At or near the intersection of the screening transition and carbon ignition lines, a minimum energy rate with very weak temperature dependence will exist and ignition at this location may allow at least initially nondisruptive, quasistatic carbon burning. Author (NSA)

**N73-33914#** Tennessee Univ., Knoxville. Dept. of Chemical and Metallurgical Engineering.
**APPLICATION OF ADIABATIC CALORIMETRY TO METAL SYSTEMS Progress Report, 1972 - 1973**
C. R. Brooks and E. E. Stansbury 1973 11 p refs
(Contract AT(40-1)-3291)
(ORO-3291-17) Avail: NTIS HC $3.00

Research on the heat capacity of liquid metals and stainless steel is summarized. Data and discussions are included on Bi heat capacity, and heat capacity of austenitic stainless steels. NSA

**N73-33915#** Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
**THERMOTRANSPORT STUDIES IN LIQUID ALKALI METAL ALLOYS**
S. P. Murarka, T. Y. Kim, M. Y. Hsieh, and R. A. Swalin 1973 18 p refs Sponsored by AEC
(COO-841-29) Avail: NTIS HC $3.00

Thermotransport was studied as a function of composition in the Na-K liquid alloy system. Thermotransport of trace concentration of Rb in K, Rb in Na, and Na in Rb were also investigated. A reversal in direction of specie migration occurred at an internediate composition in the Na-K system. In K-rich alloys Na, for example, migrated toward the hot end of the capillary whereas, in Na-rich alloys, Na migrated to the cold end. At some intermediate composition crossover occurred and consequently no thermotransport occurred at that composition. Results compare with results of electromigration studies by other investigators, which indicate that a sign reversal in direction of electromigration occurs in both the Na-K and Na-Rb systems. Author (NSA)

**N73-33916#** Sandia Labs., Albuquerque, N.Mex.
**EXPERIMENTAL-THEORETICAL CORRELATION ON THE CONTAINMENT OF EXPLOSIONS IN CLOSED CYLINDRICAL VESSELS**
R. A. Benham and T. A. Duffey Jun. 1973 31 p refs Sponsored by AEC
(SLA-73-508) Avail: NTIS HC $3.75

Containment design formulas are developed for prediction of the maximum wall deformation of a cylindrical vessel due to detonation of a centrally located bare spherical high explosive charge. Vessel wall response due to both the initial impulse loading and the long term pressure buildup is considered. Formulas, which incorporate a rigid plastic material model including strain hardening and strain rate sensitivity, are written in terms of elementary functions suitable for containment design calculations.

Wall response predictions compare favorably with the results of an experimental program performed in mild steel containment vessels closed with massive end caps. Author (NSA)

**N73-33917#** Army Foreign Science and Technology Center, Charlottesville, Va.
**APPROXIMATE METHOD OF SOLVING NONLINEAR HEAT CONDUCTION PROBLEMS**
V. V. Salomatov 10 Jul. 1973 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 1, 1971 p 132-140
(FSTC Proj. T7012301)
(AD-765747; FSTC-HT-23-2286-72) Avail: NTIS CSCL 20/13

A method of solving nonlinear problems of high-temperature heat transfer is presented; it is based on the linearization of the basic process equation, starting from the condition of minimum rms error due to violating nonlinearity; in this, the nonlinear boundary conditions are satisfied analytically exactly. Three characteristic stages are considered, corresponding to the kinetics of heating (cooling) of a solid body: the initial period, the quasi-steady-state regime, and the transition region. GRA

**N73-33468*** McDonnell-Douglas Astronautics Co., St. Louis, Mo.
**RADIANT HEAT TRANSFER IN REUSABLE SURFACE INSULATION**
T. A. Hughes, R. M. F. Linford, R. J. Chmitt, and H. E. Christensen *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 1 Sep. 1973 p 197-226 refs (For availability see N73-33461 24-18)
(Contract NAS8-26115)
CSCL 20M

**N73-33477*** McDonnell-Douglas Astronautics Co., St. Louis, Mo.
**CONVECTIVE HEATING TESTS OF REUSABLE SURFACE INSULATION JOINTS AND GAPS**
H. E. Christensen and D. A. Osborne *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 425-483 refs (For availability see N73-33475 24-18)
(Contracts NAS9-12082; NAS9-12854)
CSCL 20M

**N73-33483*** General Electric Co., Philadelphia, Pa.
**ENVIRONMENTAL TESTING OF REI-MULLITE THERMAL PROTECTION SYSTEM FOR THE SPACE SHUTTLE ORBITER**
R. Gluck, R. Romano, and H. Thibault *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 667-708 refs (For availability see N73-33475 24-18)
CSCL 20M

**N73-33484*** Lockheed Missiles and Space Co., Sunnyvale, Calif.
**ENVIRONMENTAL COMPATIBILITY OF THE ALL-SILICA RIGID SURFACE INSULATION**
S. J. Housten, J. A. DeRuntz, and D. R. Elgin *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 2 Sep. 1973 p 709-730 ref (For availability see N73-33475 24-18)
CSCL 20M

**N73-33497*** Avco Corp., Lowell, Mass.
**A NON RIGID REUSABLE SURFACE INSULATION CONCEPT FOR THE SPACE SHUTTLE THERMAL PROTECTION SYSTEM**
J. G. Alexander *In* NASA. Ames Res. Center Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1185-1225 (For availability see N73-33490 24-18)
CSCL 20M

**N73-33498*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**RESULTS OF RSI THERMAL-STRUCTURAL ANALYSIS**
O. E. Pigg *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1227-1267 (For availability see N73-33490 24-18)
CSCL 20M

**N73-33499*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**INTERFERENCE HEATING TO CAVITIES BETWEEN SIMULATED RSI TILES**
Charles B. Johnson *In its* Symp. on Reusable Surface Insulation for Space Shuttle, Vol. 3 Sep. 1973 p 1269-1276 (For availability see N73-33490 24-18)
CSCL 20M

# 34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

**N73-33918#** Nauka Press, Moscow (USSR).
**REFLECTION, SYSTEMS, CYBERNETICS [OTRAZHENIYE, SISTEMY, KIBERNETIKA]**
V. S. Tyukhtin 1972 256 p refs In RUSSIAN
Avail: NTIS HC $15.00

Actual questions of Marxist-Leninist theory are investigated in light of data in cybernetics and information theory, system analysis, semiotics, and other disciplines. The nature of philosophical knowledge is revealed in view of a systematic approach and its later role in methodological investigations. Basic principles, knowledge, and theoretical problems of reflection are considered. The basic aspects of content and forms of a gnoseological image are discussed, in addition to questions on the nature of information and its association with reflection. Transl. by K.P.D.

**N73-33919*#** Aerospace Corp., El Segundo, Calif.
**SYSTEM COST/PERFORMANCE ANALYSIS (STUDY 2.3). VOLUME 1: EXECUTIVE SUMMARY Final Report, 1 Sep. 1972 - 31 Aug. 1973**
T. Kazangey 28 Sep. 1973 31 p
(Contract NASw-2472)
(NASA-CR-135903; ATR-74(7333)-1-Vol-1) Avail: NTIS HC $3.75 CSCL 14A

The relationships between performance, safety, cost, and schedule parameters were identified and quantified in support of an overall effort to generate program models and methodology that provide insight into a total space vehicle program. A specific space vehicle system, the attitude control system (ACS), was used, and a modeling methodology was selected that develops a consistent set of quantitative relationships among performance, safety, cost, and schedule, based on the characteristics of the components utilized in candidate mechanisms. These descriptive equations were developed for a three-axis, earth-pointing, mass expulsion ACS. A data base describing typical candidate ACS components was implemented, along with a computer program to perform sample calculations. This approach, implemented on a computer, is capable of determining the effect of a change in functional requirements to the ACS mechanization and the resulting cost and schedule. By a simple extension of this modeling methodology to the other systems in a space vehicle, a complete space vehicle model can be developed. Study results and recommendations are presented. Author

**N73-33920*#** Aerospace Corp., El Segundo, Calif.
**SYSTEM COST/PERFORMANCE ANALYSIS (STUDY 2.3). VOLUME 2: STUDY RESULTS Final Report, 1 Sep. 1972 - 31 Aug. 1973**
T. Kazangey 28 Sep. 1973 376 p ref
(Contract NASw-2472)
(NASA-CR-135902; ATR-74(7333)-1-Vol-2) Avail: NTIS HC $21.00 CSCL 14A
For abstract, see N73-33919

**N73-33921#** RAND Corp., Santa Monica, Calif.
**TRANSPORTATION AND ENERGY**

W. E. Mooz Jun. 1973 23 p refs Presented at the 1st Annual Illinois Energy Conf., Chicago, 13-15 Jun. 1973
(Grant NSF GI-44)
(P-5025) Avail: NTIS HC $3.25 CSCL 21D

The use of energy in the transportation sector is discussed. Transportation in the United States presently uses about 25 percent of the total annual energy budget, and the use of energy in the sector is increasing at an average annual rate of about 4 percent per year. Over 95 percent of this energy is supplied by petroleum fuels, and the biggest users are motor vehicles. Differences in modal efficiencies are shown, with motor vehicles and aircraft the least efficient energy users. The growth in energy use by transportation is shown to be due to increasing modal energy intensiveness, shifts in traffic from low intensiveness modes to high intensiveness modes, and increasing per capita use of transportation. One may expect to see more small cars, shifts from air and highway modes to buses, trains, and pipelines, and changes in personal transportation habits. Author

**N73-33922#** Committee on Space Research (COSPAR), Paris (France).
**COSPAR INFORMATION BULLETIN, NO. 67, SEPTEMBER 1973**
A. C. Stickland Sep. 1973 65 p refs Partly in ENGLISH; partly in FRENCH
Avail: NTIS HC $5.25

An information bulletin is presented concerning COSPAR, an interdisciplinary scientific organization concerned with the international progress of research carried out with the use of rockets or rocket propelled vehicles. Reports of past meetings are summarized along with news from national and international institutes and organizations. Also included are reports from solar forecasting centers, surveys of satellites and space probes, and a bibliography of COSPAR publications. K.M.M.

**N73-33923*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**INDUSTRIAL USE OF AEROSPACE TECHNOLOGY**
James E. Burnett 1973 6 p Presented at 24th Congr. of the Intern. Astronaut. Federation, Baku, 8 Oct. 1973
(NASA-TM-X-71435; E-7713) Avail: NTIS HC $3.00 CSCL 13H

Examples are given of industrial utilization of aerospace technology generated through the NASA space programs. A.L.

**N73-33924#** Committee on Science and Astronautics (U. S. House).
**FEDERAL POLICY, PLANS, AND ORGANIZATION FOR SCIENCE AND TECHNOLOGY**
Washington GPO 1973 182 p Hearings before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 8, 17, 19, 23 and 24 Jul. 1973
Avail: Comm. on Sci. and Astronaut.

Discussions in the House of Representatives Committee on Science and Astronauts, concerning Federal policy, plans, and organization for the support and utilization of science and technology are presented. The historical background of Federal policy on science and technology is discussed, and a view of present goals, programs, and organization is derived. K.M.M.

**N73-33925*#** Linguistic Systems, Inc., Cambridge, Mass.
**THE BIMODAL SYSTEM**
A. Morand Washington NASA Oct. 1973 30 p Transl. into ENGLISH from "Le Systeme Bi-Mode" Rueil, France, Tregie Press, May 1973 32 p
(Contract NASw-2482)
(NASA-TT-F-15056) Avail: NTIS HC $3.50 CSCL 13F

The Bimodal System currently under development is an answer to municipal transportation problems of jammed streets with consequently poor service, coupled with rising costs. The Bimodal system aims at improving comfort in the bus, building up the system for existing vehicle and expressway techniques and designing and building a nonpolluting engine fueled with liquified natural gas. It also plans the construction of private rights-of-way, leading to the possibility of electrifying the vehicles and automating driving functions with a guidance system, which would eventually eliminate the driver altogether over special route sections.
Author

**N73-33926#** Illinois Univ., Urbana. Aeronomy Lab.
**DETERMINATION OF NITRIC OXIDE CONCENTRATIONS FROM ECLIPSE VARIATIONS OF ION CONCENTRATIONS**
W. L. Oliver 1973 22 p refs Presented at the 54th Ann. Meeting of the Am. Geophys. Union, Washington, D. C., 1973 Submitted for publication
(Grant NSF GA-27295)
Avail: NTIS HC $3.25 CSCL 14A

It is shown how nitric oxide concentrations in the upper atmosphere may be derived from the observation of changes in the NO(+)/O2(+) concentration ratio and electron concentration and temperature. Experimental data obtained during the 1970 eclipse at Wallops Island are analyzed to give nitric oxide concentration profiles above 130 km. A value of 2 x 10 to the 7th power/cucm is obtained for the concentration at 130 km.
Author

**N73-33927#** Bureau of Mines, Denver, Colo. Health and Safety Technical Support Center.
**ESTABLISHING STANDARDS FOR EFFECTIVE WIRE ROPE CLIP INSTALLATION**
Robert I. Fujimoto 1973 23 p refs
(BM-RI-7789) Avail: NTIS HC $3.25

The work is described which was conducted to develop standards for the application of wire rope clips on wire rope. These standards include optimum number of clips and clip nut torques for wire rope sizes 1/4 through 2-1/4 inches, when used for forming an eye attachment in wire rope. Wire rope test specimens with clip attachments were load tested on tensile testing machines to determine an effective combination of clip nut torques and number of clips for each size of wire rope to develop efficiencies above 90 percent of the catalog ultimate rope strength.
Author

**N73-33928#** Committee on Science and Astronautics (U. S. House).
**SHORT TERM ENERGY SHORTAGES**
Washington GPO 1973 928 p refs Hearings before Comm. on Sci. and Astron., 93d Cong., 1st Sess., No. 7, 3, 8 and 17 May 1973
Avail: Subcomm. on Energy

Congressional hearings are given on the causes and implications of impending shortages of gasoline, heating oil, diesel fuel, jet engine fuel, and electricity. The immediate energy shortages and policy options are discussed in three parts: (1) the character of the present energy crisis, (2) the relationship of energy growth and economic growth, and (3) the relationship of short-run measures and long-term objectives. Short term fuel shortages are given along with their effects on the electric utilities. The hearings take into account the regulated energy industries and the effect of the present situation on energy research and development. A gas field identification list is included. T.M.R.

**N73-33929#** Sandia Labs., Albuquerque, N.Mex.
**AIRVAL: DOD PROGRAM TO EVALUATE AIR-TO-AIR MISSILE EFFECTIVENESS**
T. E. Latta Mar. 1973 30 p Presented at 11th Symp. on Infrared Countermeasures, White Oak, Md., 10 Apr. 1973 Sponsored By AEC
(SLA-73-5271; Conf-730428-1) Avail: NTIS HC $3.50

The AIRVAL program has conducted a survey to determine the extent of past infrared (IR) signature measurements on high-performance jet aircraft. The results of this survey have been used to categorize broadly aircraft signatures and to indicate areas requiring further signature measurement. Measurements on the F-102 are now underway at Naval Weapons Center. The results of these measurements will be compared to signature predictions of the F-102 as calculated by Grumman Aircraft Corp. Additional IR signature measurements will be made this calendar year on the A-3, A-4, A-7, F-4, F-5, and F-14 by the measurement groups at the Naval Missile Center and Eglin AFB using advanced instrumentation and techniques. The results of these measurements will be combined with target vulnerability models and missile guidance, fuze, and warhead characteristics in a computer model to determine the predicted outcome of missile/target encounters. The results of a drone firing program will be compared to the computer model predictions.
Author (NSA)

**N73-33930#** Eurosat S.A., Geneva (Switzerland).
**AIMS, PROSPECTS, ORGANISATION, AND FINANCING**
Aug. 1972 30 p
Avail: NTIS HC $3.50

The aims, prospects, organization, and financing of EUROSAT S.A. are presented. EUROSAT S.A. was founded in January 1972 to cooperate with public authorites to ensure economical use of the possibilities offered by space techniques. Emphasis was placed on satisfying European requirements in ATC, navigation, and meteorological and communication ,satellites. ESRO

**N73-33931#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Hauptabteilung Wissenschaft und Technik.
**COST ACCOUNTING IN LARGE RESEARCH CENTERS Thesis - Tech. Hochschule Aachen**
Juergen Schulte-hillen 25 Apr. 1973 223 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-64) Avail: NTIS HC $13.25; DFVLR, Porz, West Ger. 82.30 DM

The results of cost accounting as used in large German research centers are presented. After examining the legal aspects, the goals and tasks of cost accounting in large research institutions are defined. Various production processes, as well as the resulting cost theory consequences, are discussed. The problems of main parameters which influence the cost behavior of research work are out lined, along with cost accounting methods applicable to the research centers. Author (ESRO)

**N73-32937*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**ECONOMIC AND ENVIRONMENTAL ASPECTS OF STOL TRANSPORTATION**
Elwood C. Stewart *In its* STOL Technol. 1972 p 23-34 (For availability see N73-32934 24-02)
CSCL 05C

**N73-33210** Technische Univ., Berlin (West Germany). Inst. fuer Mess- und Regelungstechnik.
**PROPOSAL FOR AN AUTOMATIC EXPERIMENTER [VORSCHLAG FUER EINEN AUTOMATISCHEN EXPERIMENTATOR]**
Ingo Rechenberg *In* DFVLR Papers on Fluid Dyn. with Emphasis on Boundary Layer Theory, Pt. 2 9 Mar. 1972 p 331-345 refs In GERMAN; ENGLISH summary (For availability see N73-33202 24-12)

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# NEW NASA PUBLICATIONS

**ASRDI Oxygen Technology Survey. Volume I: Thermophysical Properties (NASA SP–3071)**

Edited by HANS M. RODER AND LLOYD A. WEBER

A handbook prepared for Lewis Research Center's Aerospace Safety Research and Data Institute by the National Bureau of Standards. The handbook is the result of an extensive survey of the thermophysical properties of oxygen, including densities and the thermodynamic, transport, electrical, optical, and molecular properties for the gaseous and fluid states. *Paperbound.* 432 pp. For sale by the National Technical Information Service, Springfield, Va. 22151, for $6.00.

**Astronautics and Aeronautics, 1970: Chronology on Science, Technology, and Policy (NASA SP–4015)**

An annual volume compiled by the Library of Congress for the NASA Historical Office. The book consists of excerpts from newspapers, magazines, speeches, and government and industry announcements that document activities in the aerospace and aeronautical fields. Appendixes list major NASA launches during the year as well as documentation from open sources of launches of all satellites, space probes, and manned space flights. An extensive index is included. *Paperbound.* 522 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $3.10.

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